PMI

PHOTO METHODS FOR INDUSTRY

VOL. 2 NO. 1
JANUARY
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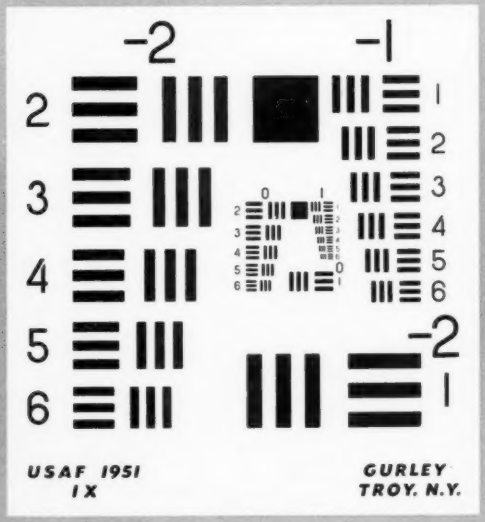
PRICE 50c

FARYNK – GM's TOP PHOTOG



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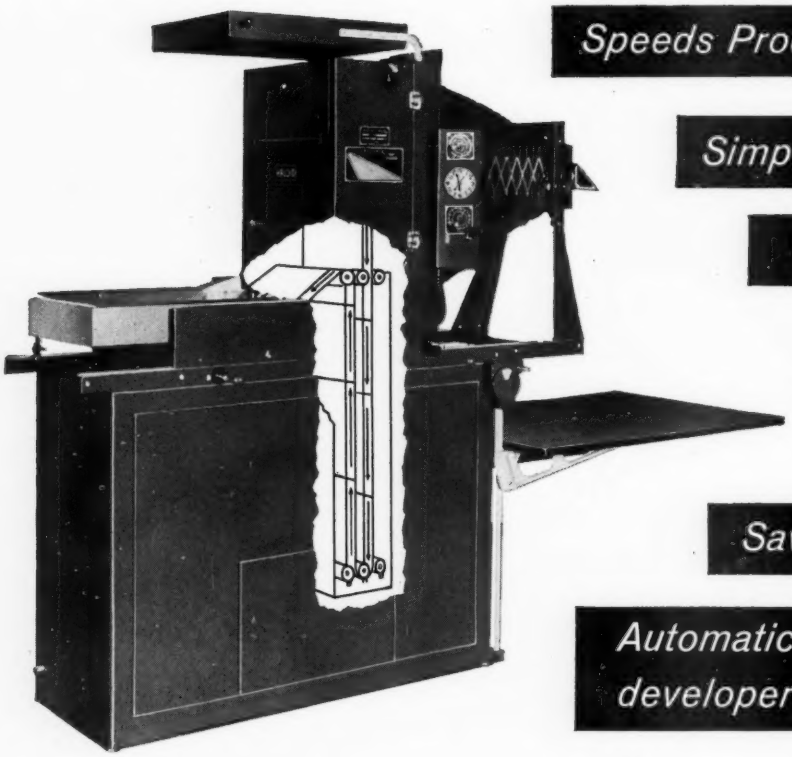

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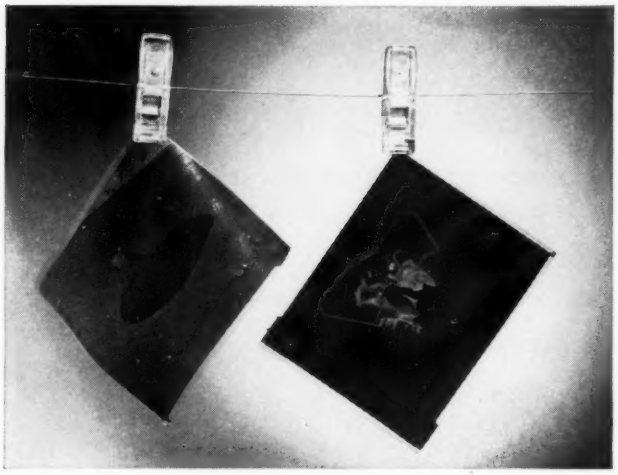
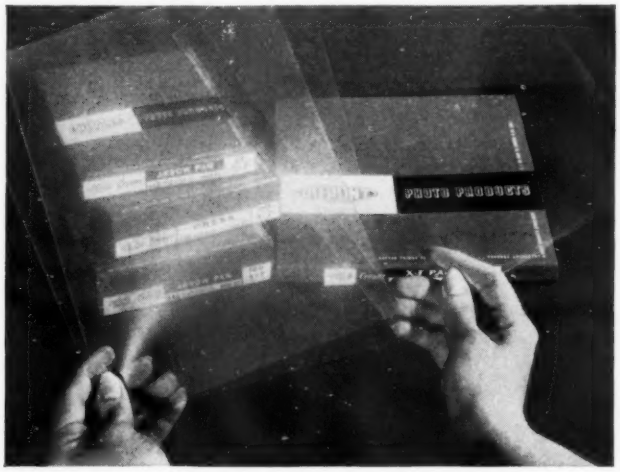
Du Pont CRONAR* sheet films on polyester base offer you important advantages

Illustrated in the photos below are only a few of the advantages of Du Pont's new line of sheet films for the industrial photographer. The toughness of polyester base, coupled with Du Pont's superior emulsions, make the "Cronar" line the most versatile group of films you can use. Now available are: "Cronar" Press, "Cronar" High Speed Pan, "Cronar" Arrow Pan and "Cronar" X-F Pan.



"Cronar" films dry faster. Both of the negatives were processed at the same time. The shot on "Cronar", right, is ready for printing. Shot on acetate, left, requires more time on the line.



Du Pont polyester film base, right, is optically clearer than acetate, left. This means sharper, crisper enlargements for your pictures shot on "Cronar" films.

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*Du Pont's trademark for its polyester photographic films

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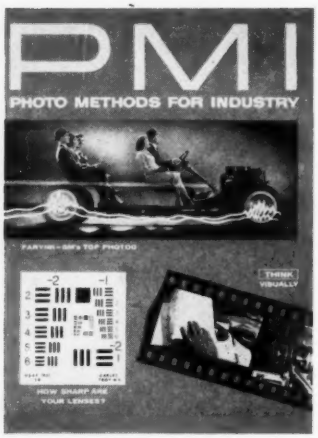

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FEATURES

23 EDITORIAL
Problems Pay Off—With Interest

24 THINK VISUALLY ***Tom Martin***
How the in-plant man can push for better A-V thinking

28 PHOTO DEPARTMENT ANALYSIS NO. 12
Lederle Labs three-ring photographic circus

32 HIGH-SPEED CAMERA CHART
PMI compares cameras that stop the show

36 PORTFOLIO NO. 11
Walter Farynk, GM's finest, shows his stuff

42 RESOLUTION TESTS ***Bennett Sherman***
How good is your lens?—Here's how you find out

48 READER'S SHOWCASE
Two pages of choice industrial pictures from PMI readers

54 T-SQUARE DANCING
Let the subject find the angles

55 S.R.E. CONGRESS REPORT

DEPARTMENTS

6 FYI
A column of personalities and news for your information

8 INDUSTRIAL COLOR
Samuel Lang & Leonard Zoref
Viewing system converts negative to positive, shows color changes

12 ELECTRONIC FLASH
Edward R. Farber
8/1,000,000 sec. flash unit? It is yours for $25 plus handiwork

14 METHODS FOR TOMORROW
Lloyd E. Varden
Game theory may become ace-up-the-sleeve for perplexed photog

16 REPRODUCTION & GRAPHIC ARTS
Herbert P. Paschel
Ansco's 3-color system, a Kodak masking idea and other pickings

18 PHOTO INSTRUMENTATION
Ernest E. Reshovsky
Atomics International films graphite atom movements at 12,500X

20 INDUSTRIAL MOTION PICTURES ***Arnold Eagle***
More magic: Stop motion to stop audiences; animation techniques

52 PHOTO BOOKS IN REVIEW

57 FREE LITERATURE
Booklets, folders and data—yours for the asking

61 NEW PRODUCTS
What's new on the market for the photographer in industry

64 IN-PLANT TEST
Werner Kuhn tests versatile 35mm tool, Asahi-Pentax K

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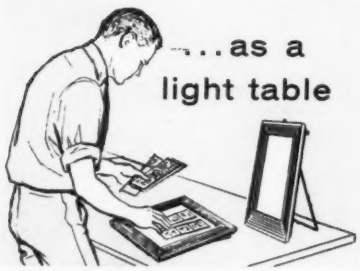

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F.Y.I.

Now that our New Year's Day head has worn off, we can finally focus on the Eastman Kodak Company's annual review of the progress of photography during 1958. This round-up performs a great service to everyone in the photographic field. Backed to the wall with the question: "What've you been doing in the past year?" we merely have to brandish the release and amaze the onlookers.

We have, for example, "helped extend the frontiers of knowledge in 1958. During this second half of the International Geophysical Year, photography went to the ends and depths of the earth and recorded phenomena millions of light years away. Super-fast color films tracked the performance of man-made missiles. Faster systems of photographic development permitted information to be analyzed seconds after it had been recorded. Slow emulsions shared the spotlight with faster ones, allowing hours-long exposures of distant objects. . . .

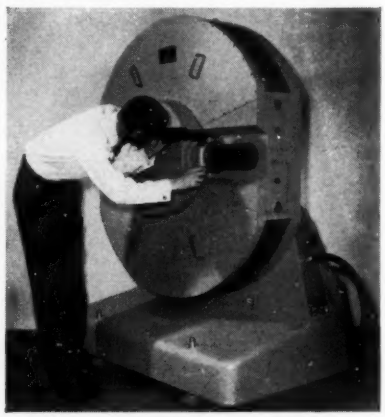
". . . Photography teamed with electronics in many research laboratories. . . . Today the output of computers can be recorded by photography at a rate of 100,000 characters a second. . . ."

Weather-eye

In-plant men photograph more tycoons than typhoons, but should the latter be assigned, photogs could hardly do better than buy a Perkin-Elmer Panoramic Tracking Camera, which covers 180° horizon-to-horizon perpendicular to the plane's flight path, and 42° with the flight path. This camera has photographed for the first time the thirty-mile "eye" of a typhoon: "Kit," of last November. Price wasn't announced but if this is the camera you need it's a good buy.

Maximum miniature

Now that Christmas is over it's safe to suggest a 35mm camera for the man who has everything. Known to a few intimates merely as the Model 192 Beckman & Whitley Continuous-Writing Framing Camera, this job records 82 35mm frames for a 55-microsecond period, and is designed to accommodate magnification velocity products up to 3mm per microsecond, or at conventional magnification, object velocities to mach 35. The camera weighs 1,800 lbs. and costs $69,500. Everready case and neck strap are extra.

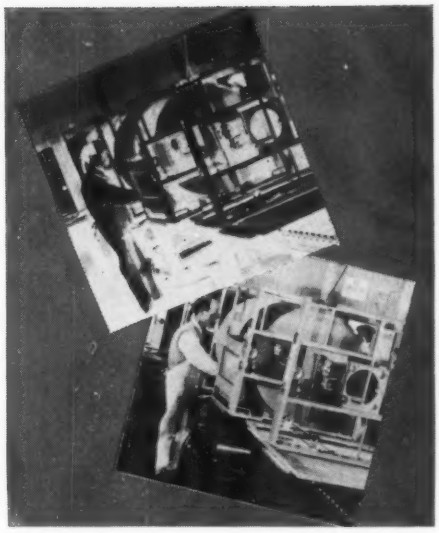


Royal box

Visiting London last October, West German President Theodor Heuss presented Queen Elizabeth II with a Leica M3 with 50mm Summicron, 35mm f/2 Summicron, 90mm f/2 Summicron, and a 135mm f/4.5 Hektor all in a special case bearing the royal cipher. Assuming—probably rightly—that Her Maj, mother of two, was going to make some color slides, President Heuss added a Leitz Prado SM slide projector. Prince Philip's loot included two Zeiss lenses, whose specifications were not announced.

(Advertisement)

NEW PHOTO METHOD FOR INDUSTRY— SLIDE-O-FILM



A 2 minute miracle-film that makes positive slides from negatives . . . negatives from transparencies. And it's done in minutes *without* chemicals, darkroom or special equipment.

WHAT THIS NEW FILM IS—

Developed for U.S. Government atomic energy scientists (originally called "Kalfax") recently released for civilian use, Slide-O-Film is a completely new system of photography—a physical system that requires no chemical process. Slide-O-Film is exposed by light and developed by heat. The original transparency or negative is placed emulsion to emulsion against the piece of Slide-O-Film and exposed to a bright light source, such as that from a slide projector. Subjecting the Slide-O-Film to a heat source is all the developing necessary. This is all done in minutes, in room light, without chemicals or costly equipment. Produced on a Mylar® base, Slide-O-Film will not tear, age or fade; it resists humidity and temperature changes and stores without dating. Free of grain, Slide-O-Film makes copies with higher resolution than that existing in any fine grain material.

WHAT THIS NEW FILM WILL DO

Slide-O-Film will produce positive or negative transparencies under normal room light—without the need for darkroom or chemicals—and all in a matter of minutes. Now instead of working for hours in the darkroom—or waiting for several days for a film processor—and for about 1/12 of your present costs you can—

(1) Make positives from black and white negatives for projection, etc.

(2) Make negatives from color transparencies for prints, enlargements, etc.

(3) Make positives from Kodacolor negatives

(4) Make negatives from Polaroid transparencies

(5) Make negatives from single 8mm or 16mm color or black and white movie frames

INDUSTRIAL APPLICATIONS—

Slide-O-Film is adaptable for work with all types of inplant photography, audio-visual programs, sales presentations, microfilm work, X-Ray films, engineering blueprints, plans and charts, etc. Due to the fact that Slide-O-Film is so new and different each day sees new uses coming to light. For this reason the Charles Beseler Company has established a Slide-O-Film Research and Education Department —this department is ready to cooperate with you in examining the specific application of Slide-O-Film to your company's operations.

For complete information on Slide-O-Film and for specific adaptations to your work, address your inquiries to

Research & Education Dept.
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204 South 18th St.
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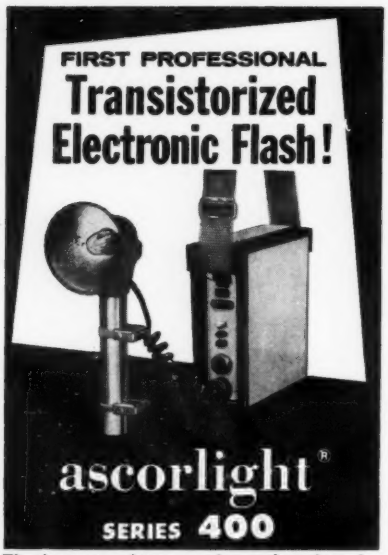
Get more information. Circle 405, page 59



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Get more information. Circle 401, page 59

by Samuel Lang & Leonard Zoref

INDUSTRIAL COLOR

Viewing system converts negative to positive, shows color changes

With all the advantages of negative color, a minority of professional color shots being made today are done with the negative-positive system. Why should this be? Well, the biggest stumbling block is the negative itself. Photographers, production men, and clients are used to seeing finished color in a matter of a day or two, or in fact sometimes even within a few hours. We know that occasionally the color may not be the most accurate, but the finished transparency is accepted in most cases as the final and ultimate color.

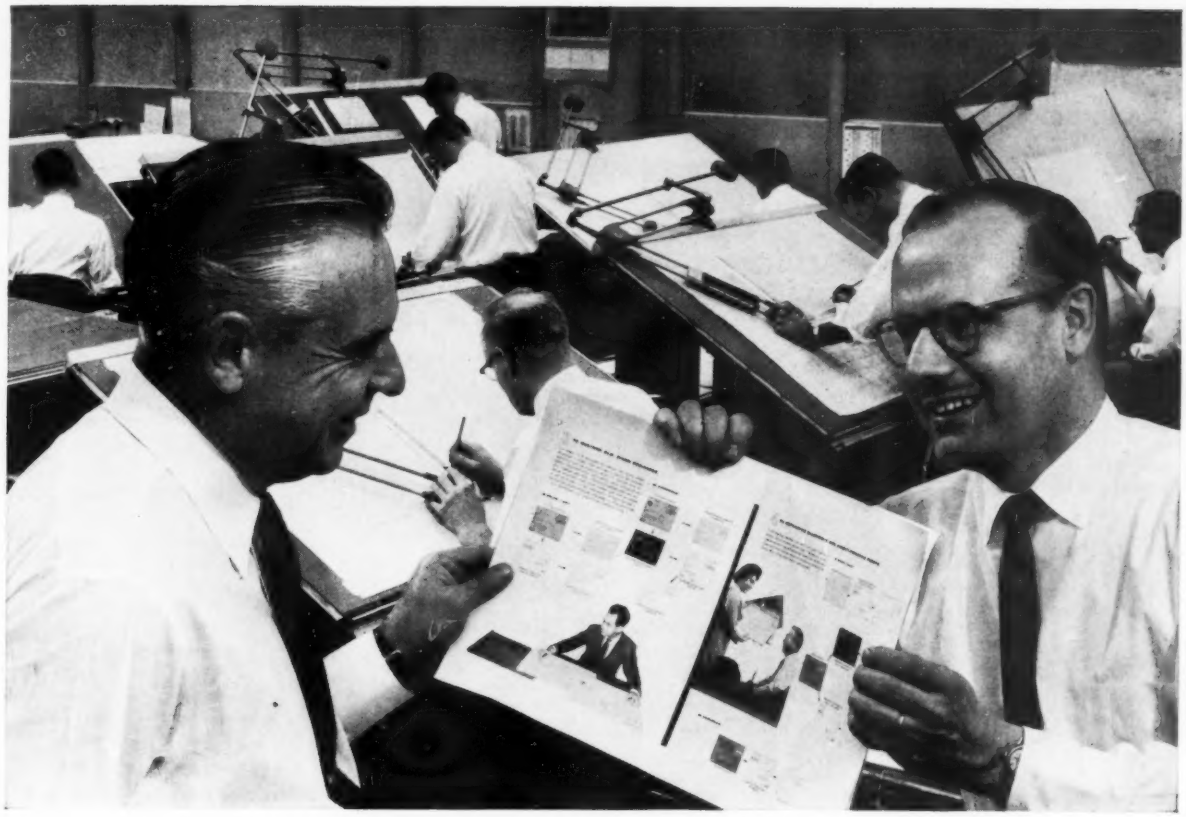
The subjectivity of color

Let us discuss a possible solution of this problem, which is viewing the ultimate quality possible from the color negative. The first workable method wouldn't be too practical since it would call for making 10 to 20 color variations of each negative exposed. This would have to be done from every negative of each different situation, because the right color balance of one negative does not necessaarily mean that the same color balance will be correct for a similar negative that was shot at a slightly different time and with a different focal length lens. A better illustration of this would be a subject on one negative that consists of two thirds sunlit area and one third shadow. Obviously this should be printed for the sunlit area, but suppose you want to crop the negative and print something important that is in only the shadow area. You then would have to change the color balance in order to make the picture more pleasing and acceptable. To go even further, we may even want to print the entire negative with two color balances, one for the sunlit area and one for the shadow area. In order to do this we would have to see two prints: one balanced for shadow, the other for sun. Then the two color balances can be combined into one print.

The ideal method then would be an instantaneous viewing device by which we could see immediately the negative in full positive color. The device should also be able to alter the color balance at will, while viewing the negative. Such a device, amazing as it may sound, would be used in the second method. It was demonstrated to us and a group headed by chief photographer Morris Gordon from the Western Electric Co. The device was built by the Hazeltine Research Co. and is housed at the Pathe studios in New York. It took several years to work out and construct, and was built primarily at the request of the motion picture industry which is now using vast quantities of negative color. In fact while waiting for our demonstration, we watched the timing and color balancing of a few sequences of the motion picture, *The Inn of the Sixth Happiness*. We were told that normally an uncorrected work print is made from the negative. From this print corrections are made. As many as six work prints are necessary for a good final color print of the movie. With this device we watched the color technicians balancing each scene as viewed so that the first work print made would be either on-the-button or require only slight corrections. We were told by the Hazeltine that the color previewer is accurate to a CC.03 density. So you can see the enormous amount of time and money saved using this technique with a color motion picture.

How it works

A very simplified explanation of how the machine works follows. It is basically a closed circuit color television set-up, with some modifications. Instead of using a standard three tube color camera focused on the negative, the Hazeltine people use an ingenious set-up whereby the negative is viewed with a flying spot;



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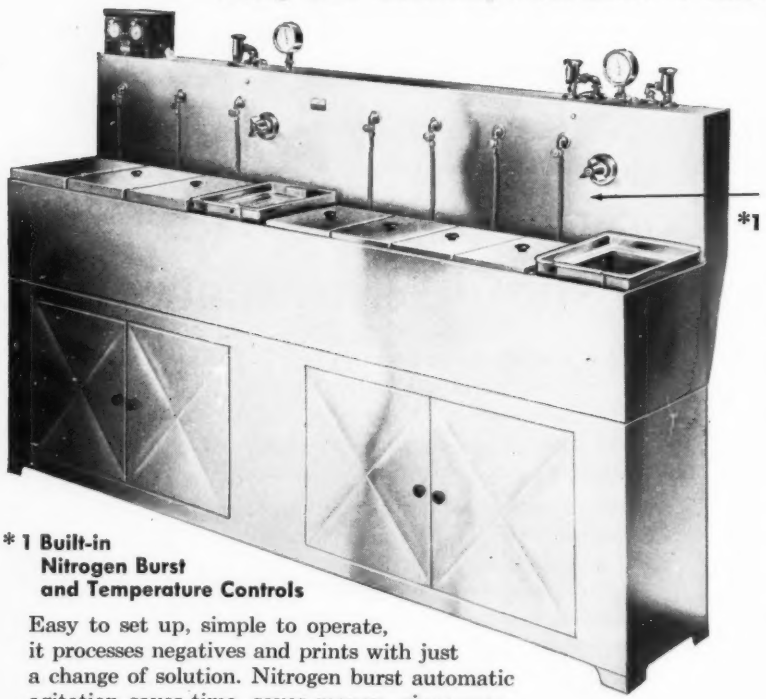

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Get more information. Circle 408, page 59

this in turn is split into the three separate colors through dichroic mirrors. In this way they have more accurate control of register of the three images and of color purity. Farther down the line, the image is reversed electronically, and amplified so that it can be fed into a standard RCA color tube. Here again a novel device called a matrix is used. This allows some of the colors to spill over into the next color channel, thus enabling them to match the curve characteristics of the printing medium, which invariably has overlapped color curve responses. Then by simply plugging in a different matrix they could make the apparatus match the response of paper, print film, etc. The operator has four basic controls at his disposal. Three are for color, one is for exposure. The color dials are calibrated in CC filters and are calibrated from an unknown reference. Morris Gordon brought some 35mm Kodacolor negatives that he shot on his recent European trip to the Photokina. When each picture was on the screen he was able to tell the operator to adjust it to warmer, colder, lighter or darker tones until it looked the way he wanted it. Thus he could see instantly how one negative looked with various color balances. Then, when he finally picked a color balance and density he liked, the color balance information was available on the dial settings and could have been given to the lab for a print made to match what had been seen on the screen. Naturally, if he wanted to, he could have edited his negatives at the same time since he would have seen them as greatly enlarged color positives (this was a 21-inch color tube).

Not too tiny

Maybe we are peeking a bit too far into the future with equipment like this. The color previewer occupies a room approximately 9 x 12 ft. and has over 200 vacuum tubes in its circuitry. The Hazeltine people are planning to lease their machines due to the high cost of the prototype. There is a possibility that the next one they build will be transistorized, thus eliminating a great deal of bulk and heat producing tubes.

We all agreed at the end of the demonstration that this would be the ideal way to handle color negatives from the point of view of both photographer and laboratory. Who knows, with the wonders of electronics, if they may not come out in a few years with their portable model?—THE END

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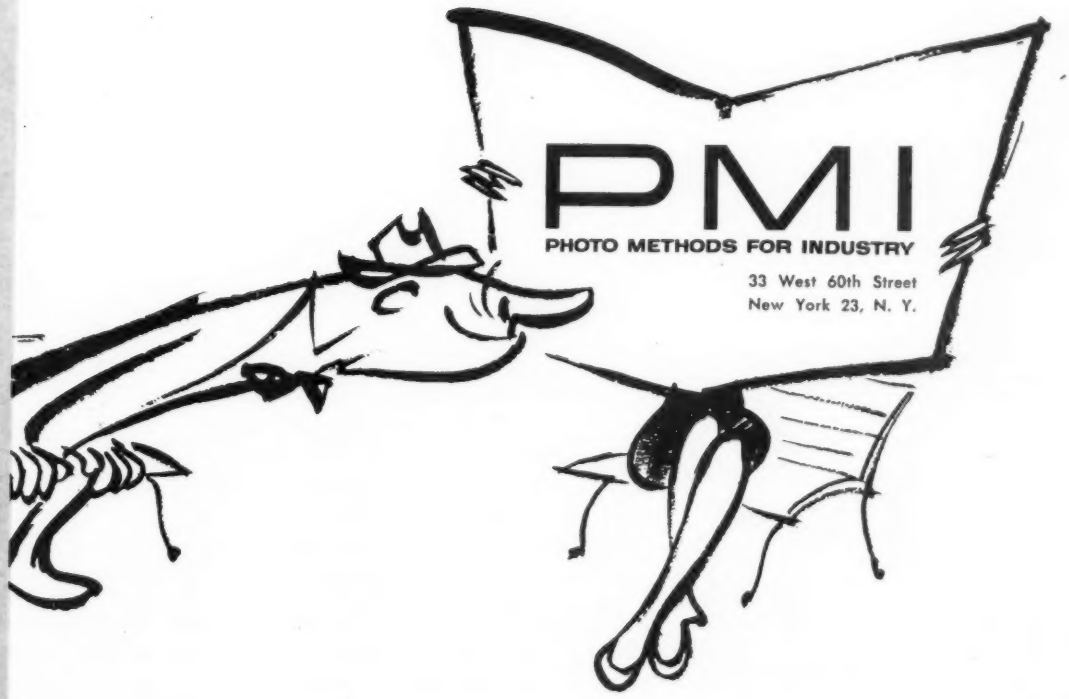

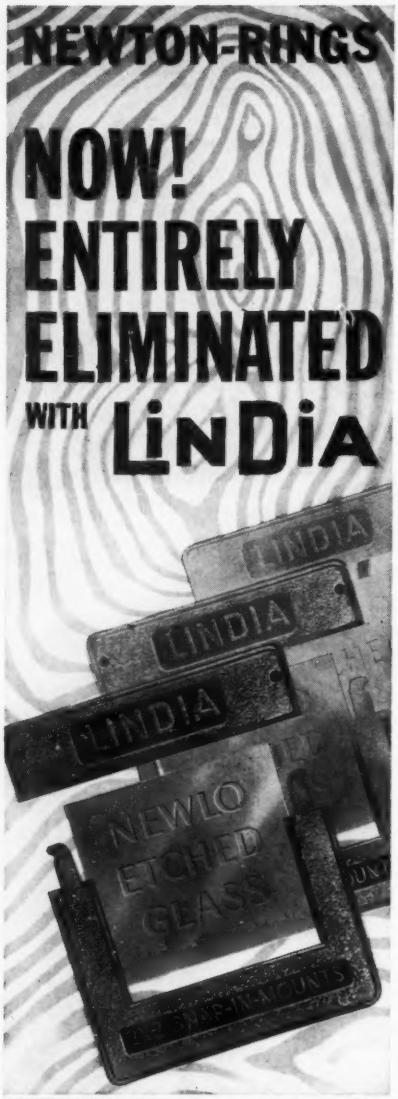

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by Edward R. Farber

ELECTRONIC FLASH

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A small flashtube recently introduced by General Electric lends itself admirably to the construction of a compact and inexpensive 8 microsecond (1/3 peak) flash unit anyone with some familiarity with electronics can make.

The GE FT30 tube is only 2⅛ in. long, the diameter of a cigarette. An electrode protrudes from each end, and the glass body is covered with an invisible conductive coating that serves as the trigger electrode.

Operating characteristics

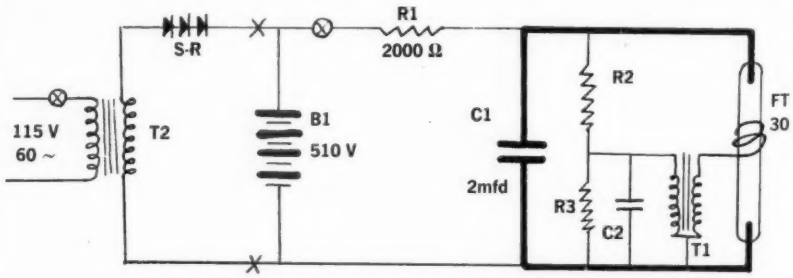
It will operate at voltages between 120 and 500, and though it was designed primarily for low energy repetitive flash operations, it can be used with energy inputs as high as ten-watt-seconds per flash at low flashing rates (with some sacrifice in tube life).

Typical applications will give you an idea of the operating characteristics of the tube. One might be an ignition timer with a 30 mfd capacitor charged to 130 volts, giving an estimated tube life of 25 hours at four flashes per second, or a stroboscope operating at 350 volts with 2 mfds at 50 flashes per second giving a 50 hour tube life.

The tube manufacturer has suggested a simple circuit that will enable anyone with a little electronic background to construct the 8/1,000,000 sec. flash unit in a few hours at a cost of about $20 for parts. These can be ordered from a radio parts supply house such as Allied, 100 N. Western Ave., Chicago 80, Ill., or Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N.Y. The flash tube can be ordered from your nearest GE photolamp department. It retails for $4.32.

Construction

Parts can be mounted on a wooden base or metal chassis. Their arrangement is not critical except for relationship between the flashtube and flash capacitor. These leads between them should be short and straight. Best practice is to mount the tube directly over the capacitor. This avoids any possibility of prolonging the discharge time because of resistance and inductance of the discharge circuit. Use No. 14 wire or heavy clips. If the space requirements on a particular assignment re-

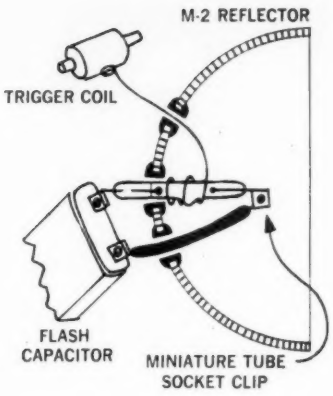


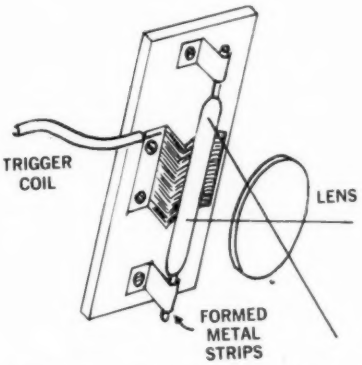
Note: for AC use, disconnect battery and connect AC pack at x and x.

PARTS LIST

For Battery Operation B1 500-volt battery, Eveready 497 or Burgess U320 **R1** 2000 ohm 2-watt Ohmite Resistor **R2** 1 megohm 2-watt Ohmite Resistor **R3** .51 megohm 2-watt Ohmite Resistor **C1** 2 microfarad 600-volt oil filled paper capacitor **C2** .25 microfarad 600-volt oil filled paper capacitor **T1** Trigger coil Model L or LL127, Model Electric Co., 1500 Banks Ave., Asbury Park, N.J.

For AC Operation remove battery and substitute power supply **T2** Power Transformer Stancor P 6425 **SR** Selenium Rectifiers three 65 milliampere, 150 volts





quire extreme compactness, the capacitor, spark coil and flashtube may, of course, be separated from the power supply without affecting duration.

Be sure all connections are carefully soldered. Use rosin core solder only. Remember too, that capacitors hold their charge, so short across the terminals with an insulated screw driver before touching anything with your fingers. When laying out the parts, be sure there is no possibility that high voltage leads can ever short across to the trip lead to the shutter.

Mounting

Two of the possible ways of mounting the flash tube are illustrated. When a lens is preferred, a plastic lens such as the Fresnel type by Optics Mfg. Corp., Amber and Willard Sts., Philadelphia 34, Pa. may be used. These large lenses with excellent light gathering qualities can be employed to light small areas at great distances, and are not expensive. With fast film this unit should have a guide number of about 12 using the M2 reflector. If more light is needed, several units can be operated in parallel with good synchronization, if trip leads are similar in length.

It is also possible to operate several capacitor flastube combinations from one power supply.—THE END

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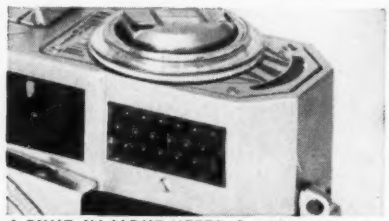

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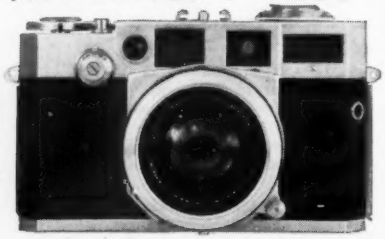

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Get more information. Circle 404, page 59

by LLOYD E. VARDEN

PHOTO METHODS FOR TOMORROW

Game theory may become ace-up-the-sleeve for perplexed photog

Can the game theory be applied in industrial photography? There are many possibilities that certainly seem worth investigating.

Game theory is so new, relatively speaking, that its meaning and applications have not filtered down to the everyday practitioner. The name "game theory" implies, unfortunately, that it concerns only parlor games. Indeed it can be used to decide the preferred strategy for winning many parlor games, but actually the theory has a much broader scope, and is becoming the backbone science for "solving" problems which used to be considered beyond the realm of mathematics. The best decisions to make in such instances were left to people having the greatest experience.

Game theory, in the broadest sense, pertains to the most logical—or at least systematic—approach to the solution of problems that involve a conflict of interest. The expression "conflict of interest" does not refer necessarily to personal interest. For example, in arriving at a particular decision there are often variables involved over which one has only limited control. These variables, in turn, may strongly influence other aspects of the problem situation. Thus, conflict of interest cannot be reduced to a simple concept such as, (a) I want to win; (b) he wants to win. This represents an *example* of interest conflict, but so does highest film speed and minimum graininess, which are impersonal.

An example from the recently published book entitled *The Compleat Strategyst* by J. D. Williams (McGraw-Hill Book Co.) will perhaps show better how game theory can be applied outside the parlor. It also conveys—with no need for explanation— the idea behind "conflict of interest."

"The firm of Gunning and Kappler manufactures an amplifier having remarkable fidelity in the range above 10,000 cycles. . . . Its performance depends critically on the characteristics of one small, inaccessible condenser. This normally costs Gunning and Kappler $1, but they are set back $10 if they must replace a defective one.

"Of course, there are some alternatives open to them. They know a test procedure which will catch a defect three times out of four; unfortunately, it costs $1 to apply the test. They know another which is sure-fire and of negligible direct cost, except that nine times out of ten, it results in breakage of good condensers. It is possible for them to buy a superior quality condenser, at $4, which is fully guaranteed; the manufacturer will make good the condenser and the costs incurred in changing it."

Now the problem obviously is to decide the wisest and most economical strategy this firm can adopt. Game theory provides the technique for solving the problem. This is a simple example, and so I shall leave the solution to you.

For photo game too

But it does not take much imagination to rephrase this problem in terms of photographic laboratory operations. All of the quality and cost considerations have counterparts in the problems encountered in photographic practice.

Game theory, though, is by no means limited to problems of economics. The first book published on the subject (1944) might give this impression because its title is *Theory of Games and Economic Behavior*. But the authors, von Neumann and Morgenstern, presumably used this title to forestall the interpretation of game theory as being applicable only to parlor games. (I have borrowed this opinion, incidentally, from the

book, *Games and Decisions* by R. Duncan Luce and Howard Raiffa, John Wiley and Sons, Inc., 1958).

It seems to me that game theory should have numerous applications in photography. There is no lack of interest conflict. Consider these possibilities, as *examples*. Film speed and graininess (already mentioned), depth of field and lens aperture, light source characteristics and film color sensitivity, image stability and speed of processing, cost and quality level and other variables.

Situations arise every day where these and many other conflicting interests must be resolved. To arrive at the best decision one cannot always depend upon experience.

Creative cine editing

It is generally conceded that creative ability is an innate characteristic. "Knowledge of technical and mechanical details can be acquired," quoting Mr. William Van Praag, but not so with creativeness. Nevertheless, Mr. Praag strongly believes that a creative person can contribute more if he is familiar with a working knowledge of technical facts. For this reason he has prepared an illustrated paper for free distribution entitled *A Primer of Creative Editing*.

Mr. Praag has done a remarkable job in presenting the essentials of film editing so thoroughly within 23 typewritten sheets, double-spaced. Actual film samples are stapled on the pages to make the step-by-step procedures clear, and flow charts show the relationships between various stages of film production.

The publication is available from Van Praag Productions, with offices in New York, Detroit, Chicago, Miami and Hollywood. The New York office is located at 1600 Broadway.

Story of technology

If you have a management superior who is not convinced of the value of industrial photography beyond a very limited scope, I suggest that you write to Du Pont, Public Relations Dept., Wilmington, Del., for a copy of their recent 36-page booklet called *The Story of Technology*. If the fact that Du Pont could not have presented the message they wanted to without photography is not made obvious to your superior, then you had better transfer elsewhere.

This publication is jam-packed with very effective industrial photographs, both black-and-white and color. And the nice thing about it, for purposes of convincing argument, is that historical events before the days of photography are illustrated by wood- (*Continued on page* 51)

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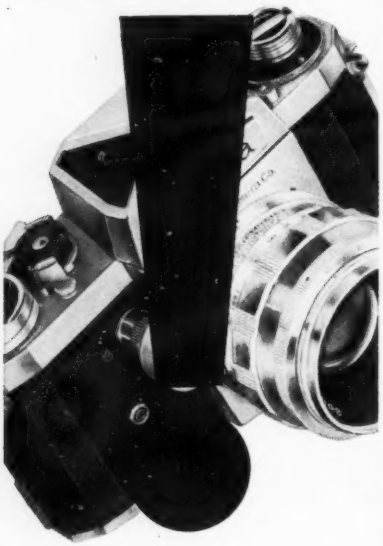

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by Herbert P. Paschel

REPRODUCTION & GRAPHIC ARTS

Ansco's 3-color system, a Kodak masking idea and other pickings

A simplified, direct-halftone separation technique was outlined by Ansco representatives at the Boston Convention of the National Association of Photo Lithographers. The method is intended to produce screened separations of a quality adequate for inexpensive, pleasing three-color printing and does not require specialized camera equipment. Conventional process cameras, as well as standard enlargers, may be used if equipped with a vacuum film holder or easel.

The current method is an abbreviation of a previous Ansco technique for four-color work. In the three-color system the magenta and yellow printers are exposed on Reprolith Ortho Type B film, the cyan printer on Reprolith Pan, in each case through a neutral density contact screen. A feature of the method is the control afforded by visible development of the ortho films under standard ruby darkroom lamps. Even the panchromatic film may be inspected for short periods under green safelight illumination.

Reflection type copy and transparencies can be reproduced with equal ease. Although masking is possible in conjunction with the basic system, reasonably good reproduction can be obtained in the majority of cases without resort to masking. Complete operating details are outlined in a 16-page booklet *"3-Color Printing with Ansco Graphic Arts Materials,"* available from the Graphic Arts Department, Ansco, Binghamton, N. Y.

A specialized separation camera, designed primarily for producing direct screened separation negatives from color transparencies was shown at the recent N.Y. Letterpress Forum. Built to conform to the requirements of the Kodak three-color process, the camera will handle transparencies from 35mm up to and including 4 x 5 inches in size. Maximum projected image area is approximately 9 x 13 in. in the standard model, up to 17 x 22 in. with an optional, oversize vacuum board. It is a completely self-contained unit with provision for making the single correction mask directly in the transparency holder. The Kodak register pin system is used throughout. A 16-page booklet giving detailed instructions on short-run three-color techniques and the operation of the three-color camera is available from Short Run Color Corporation, Cleveland 14.

More about color

Throughout the years Kodak technicians have been extremely prolific in devising masking methods for color correction. Just about the time craftsmen finally master the intricacies of the current technique, along comes Kodak with a newer and cuter scheme—or so it seems. The latest in the series provides color correction of continuous-tone separations from color prints or other color-reflection copy. Correction is achieved by means of three silver masks, on film, which are used, in appropriate sequence, to mask each of the separation films during exposure. A black separation is made by partial exposure through each of the three masks. Film is used throughout and all operations are performed at the back of the camera. Registration is obtained by either of two methods: (1) a Kodak Register Printing Frame mounted on the plate bars or screen bars of the camera; (2) a register pin strip attached to the vacuum back of the camera. The accuracy of correction is easily established by visual evaluation of the color patch records on the negatives. For the photomechanical processes requiring halftone images, screened positives are made direct from the corrected separations, halftone negatives by contact from the screened positives.

Complete working instructions for

Camera Back Masking with Silver Masks are given in Q-Sheet 101, an 8-page technical information pamphlet obtainable from the Sales Service Division, Eastman Kodak Company, Rochester, N. Y.

With publication of Q-101, Kodak inaugurates a new series of "preview" pamphlets designed to provide the graphic arts industry with advance technical information on new developments. Registered owners of Kodak Graphic Arts Handbooks will automatically receive copies of the Q-sheets as issued.

Old ideas in modern form

Originally, reflex photocopying was a two-stage operation, a negative was first prepared by the reflex technique from which as many positive prints as desired were then made by contact. In both stages processing was the conventional develop-fix-wash-dry. Equipment and space requirements, plus the mess and time lag in wet processing, made the method somewhat unsuitable for general office copying.

Not until the advent of the diffusion-transfer-reversal process of photocopying, and the compact machines combining mechanized exposure and processing, did the reflex method establish itself as an important tool in the modern business office. DTR photocopying is, unfortunately, a single copy process. Additional copies each cost as much as the first and take as much time. The Cormac PolyCopy Process, recently introduced, is intended as an adjunct to existing DTR installations. It provides the means for making multiple copies with the same speed and ease, but at half the cost, as DTR copies.

PolyCopy is actually nothing more than the second stage of the older reflex system simplified and mechanized by means of single-stage, machine processing. The PolyCopy process comprises a developing machine ($79.50), positive contact paper and a special mono-bath concentrate. Required companion equipment is an exposing unit of some sort and the means for making a negative. Any of the DTR photocopy machines on the market will serve the above purposes.

A DTR negative, normally discarded, or any other type of negative on film or paper is used for making PolyCopy contact positives. Negative and paper are exposed in the normal contact arrangement (emulsion-to-emulsion). The exposed paper is then inserted in the developing machine where developing and fixing

(*continued on page* 50)

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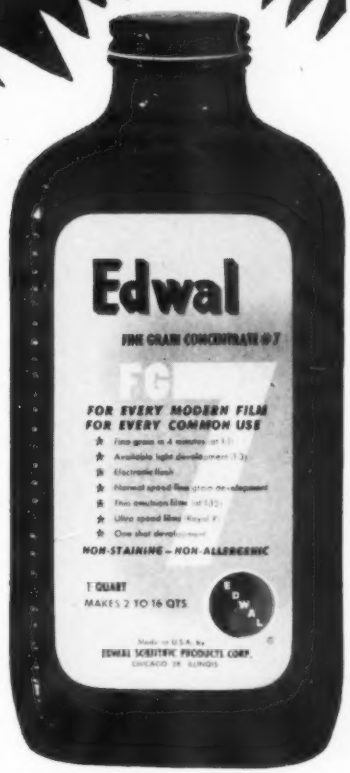

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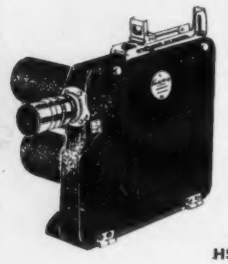

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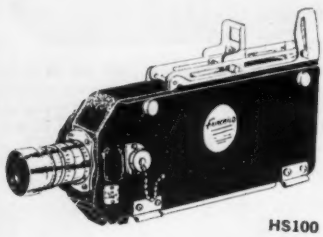

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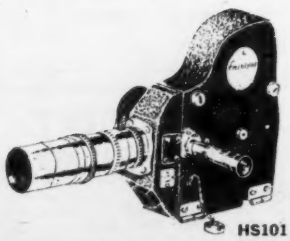

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by Ernest E. Reshovsky

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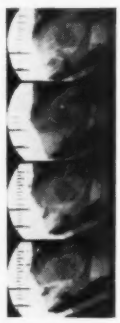


Graphite is an important material used in nuclear reactors. Dislocations in the material affect its physical properties, thereby influencing its conductivity, strength and other mechanical properties.

A unique motion picture, produced at Atomics International, actually shows dislocations in the atomic arrangement in the structure of graphite. The film has aroused considerable comment among researchers in the field and is the result of very close cooperation between the scientist conducting the experiments and the motion picture photographer.

Dr. Alexander Grenall and Gerald Bettger, the photographer at the company's headquarters in Canoga Park, Calif., were responsible for the picture, made under contract with the AEC.

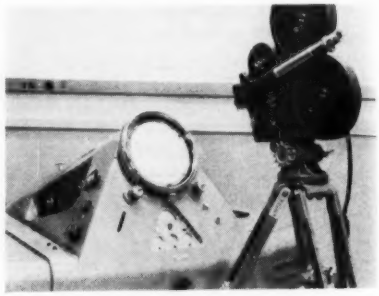
What was needed was a motion picture record of the electron microscope screen while the experiment was in progress. The magnification of 12,500X and 25,000X which was required for the experiment made for a rather low screen intensity and actual light meter measurement proved inconclusive.

"We did use a GE PR1 meter right up against the screen surface and came up with readings of 0.8 c/sqft (candles per square foot, a measure of illumination) at 12,500X magnification, and 0.4 c/sqft at 25,000X magnification. This information was used as a basis for further photographic tests."

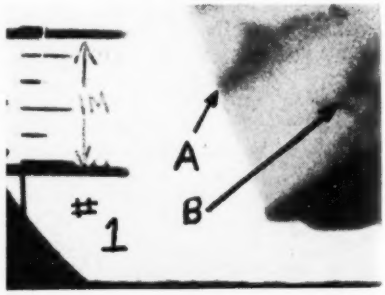
For the initial photographic testing, Bettger mounted a 16mm camera at a distance of 18 in. from the scope. Equipped with a 1-in. f/1.4 lens, the camera was operated at 24 fps with the lens set at full aperture, exposing Tri-X reversal film. The resulting footage showed only a vague image and further tests were decided upon for the work.

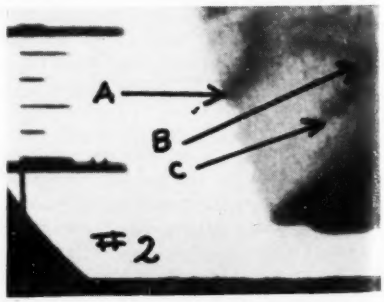
Finally, a Bell & Howell 70J camera, equipped with a 1-in. f/0.95 Angenieux was substituted. Tri-X negative 16mm film was chosen for its speed and sensitivity to green, which is the color of an electron microscope screen. This time the camera was operated at 16 fps with the lens at full aperture.

"Telefilm Inc. in Hollywood, did our processing and deserves a great deal of credit for helping us with some of the exposure problems,"



70J in position





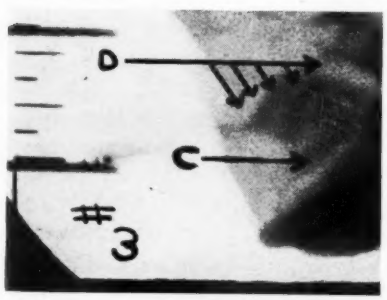
16mm film of graphite shows action as stress generator (C) sets up strain

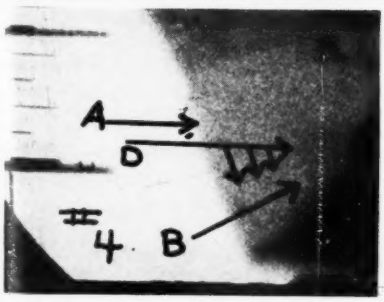
continued Bettger, "they cut our 100 ft. test into ten sections and ran each section at a different processing speed, reducing their standard 15 ft/m (feet per minute) in steps to 5 ft/m. The result was that we arrived at a speed of 10 ft/m which showed our best exposure and this speed became the standard to which we exposed our footage. Checking our exposure, we find that we exposed our negative to an equivalent of about ASA 380."

Since dislocations in the structure of graphite are very hard to observe, much less to foresee, it was decided to leave actual operating control of the camera in the hands of Dr. Grenall, who was conducting the research experiments. Dr. Grenall spent over a month exposing the footage in 400-ft. reels, running the camera only when a dislocation manifested itself.

"Once I had spotted a dislocation or imperfection in the crystal," said Dr. Grenall, "I could turn on the camera, which was pointing over my shoulder, and record the spread of the dislocation."

All in all Dr. Grenall exposed twenty-five 400-ft rolls of negative. "This had to cut down to a motion picture of 800 ft.," continued Bettger, "and Dr. Grenall worked with me all the time during the editing of the film. We worked side by side during a week, with Dr. Grenall pointing out each frame where a cut was required. We worked together on each splice and each sequence. Only with cooperation of this kind could as technical a project as this one be a success." —THE END





fields *(A & B)*, which form dislocation loops *(D)*, to bring calm *(picture 4)*

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by Arnold Eagle

INDUSTRIAL MOTION PICTURES

More magic: Stop motion to stop audiences; animation techniques

Like time-lapse technique which we discussed last month, stop motion and animation are part of "magic" cinema techniques. In time-lapse photography, the dimension of time is condensed and the invisible movements of growth and development become visible. In stop motion, however, the usually visible source of movement becomes invisible. Animated objects suddenly spring to life and start to move around by themselves as if propelled by an invisible power.

With stop motion, for example, you may have the pieces of a wrench set jump out of a tool box, arrange themselves on a bench and proceed to assemble a piece of machinery—untouched by human hands!

The technique and equipment needed for stop motion movie photography is similar to that used for time-lapse shooting, except that for stop motion you'll not need an automatic triggering device. Your camera must be mounted on a tripod or animation stand which is absolutely rigid. It should be secured to an exact spot and must be immovable even when accidentally shoved.

The camera should be capable of making single frame exposures, or have a single frame animation motor and an accurate frame counter. Since a great deal of effective stop motion shooting includes close-ups, viewing and focusing should be done through the lens.

Mathematically, it's quite simple to determine the distance an object should move in stop motion photography. Remember, projection time is always 24 fps. If an object, say a wrench, is going to move 2½ ft. in 5 sec., then all you have to do is to divide the number of frames into the distance covered by the object. In this case it would be 5 x 24, or 120, divided into 2½ ft., or 30 in. Thus you will have .25, or ¼-in. of object movement for each frame. However, you can take more than one exposure per movement. Then, naturally, projection time will be longer and the movement will appear slower on the screen. You can also move more than one object at a time.

As in time-lapse shooting, lighting must be constant. And usually there can be no panning or dollying. If you must dolly, the camera should be mounted on an accurate animation stand or a finely geared lathe. Then you may move the camera in and out after each exposure, keeping the lens in focus by using follow focus techniques. Camera movement and focusing must be figured out on an accurate scale. Panning, or rather trucking, can be accomplished by moving the objects and background sideways before the camera. But if you do not have a precision animation set-up stick to the stationary camera set-up, allowing the objects alone to move.

The exposure time in single frame shooting is critical. It is advisable, urgently, that you determine the precise exposure time of your particular shutter before launching into a lengthy, full-scale production. Make a few test runs to be sure.

Applied animation

We usually include under animation the use of cartoons and drawings which change with each frame. This type of animation demands a great deal of skill, art training and technical experience—to say nothing of requiring an animation stand and a great deal of time. However, a simple form of animation—using single frame stop motion—can be attempted even by those with limited film making experience. For instance, a ventilating system may be outlined on a floor plan by means of an animated dotted or continuous line; or the growth of an industrial plant may be indicated by shading the expanding portion on a map. All this needs is simply a single drawing or photograph. Without moving either it or the camera, the line may be extended or the area shaded after each exposure has been made.

Each problem in single frame shooting requires its own solution and calls for inventiveness and ingenuity on the part of the cameraman. He must find his own technique or gadget. For example, to make a curving and jagged animated line, a cardboard cutout, conforming to the intended shape, may be used as a pattern. (Naturally, the cardboard must be removed before each exposure.)

The animated single frame exposure is essentially useful in making imaginative titles. Cut out, scrambled alphabet letters can suddenly rearrange themselves and move to their proper places to spell out a title. Or a piece of chalk can mysteriously write by itself on a blackboard.

One accurate method of having script appear on a blackboard is to shoot it from finish to start. First of all, write the whole message on the board. Then wipe it off thoroughly, little by little, making your single frame exposures each time you erase some of the message. As in all reverse shooting, the camera is held upside down while shooting. When the negative is developed, the strip is turned around and then spliced into the film. Make sure to use double perforated stock so that sprocket holes will match when the film is flipped.

When the film is projected, action will be in a forward-going direction —in spite of the fact that it was really shot backwards.

By shooting this type of written title backwards you can be assured that the final message will look exactly as you want it, and that it will occupy precisely the space on the screen that you had planned. The other way, that is shooting from the beginning of the message and building it up on the blackboard from the first word to the last, may produce undesirable and obvious breaks in continuity. Many professional animation studios have as standard operating procedure the practice of making a black-and-white test first, on positive film, before executing the final film in color.

Reverse single frame shooting can produce some very interesting effects which give the impression of time-lapse photography. Take apart a piece of equipment, one bit at a time, alternately making your reverse single frame exposures. Better try this on equipment that's easy to disassemble and not too complicated—a chemical lab set-up with enough equipment to give a pleasing design, for example. After processing, turn the film around and, projected, it will show an amazing and enigmatical self-construction. —THE END

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AN EDITORIAL

PROBLEMS PAY OFF—WITH INTEREST

Upsetting though the fact may be, let's face it: three out of five good photographers working in industry are bored stiff. They know three times as much photography as they are generally called upon to use, and on the rare occasions when fate breaks routine and tosses them a juicy technical problem to work out, it's such an event that they make speeches about it at meetings and conventions for the next ten years.

A bored expert is a dead loss. Not only is it a kind of vandalism to destroy the keen enthusiasm a technician always has on starting a new job, it's a short-sighted, chowderheaded way to run a company. Photographers cost money. Anybody who hires one then doesn't get his money's worth out of him is just a jerk.

If you're a photographer it's up to you to figure out ways in which your knowledge can be useful to your company, in production, research, publicity, instrumentation—hundreds of up-to-the-minute techniques are ready to make you yourself more valuable and your job more interesting. When you've found the technique that looks like it'll pay off for your firm—holler. Holler until the brass gives you a chance to show what you can do when you've got a real problem to sink your teeth into.

If you are the brass, don't waste time worrying whether or not you're getting the best out of your staff—just holler. Holler for a photographer whenever you've got a problem, whether or not you think photography could solve it. You'll be astonished to discover just how many tricky situations can be saved by photographic techniques you've never heard of.

Your photographer's heard of them, though. That's what you pay him for.

The Editors

WANT BETTER A-V? THINK

The best—and only—place to start putting the punch in any visual material you are called upon to produce is in the minds of the people in your company who use your services. We might as well be honest: this is the toughest part of the job. Since what finally appears on the screen depends to a great extent upon what was requested in the rst place or produced before your department got its hands on the project, your only hope is to make your influence felt **early.** True, you can't (at least in our shop) go screaming to the big brass that "We do it this way, or else," but you **can**—by knowing your job and by building confidence in your department—encourage your clients to "come in and talk it over" so you can help them give birth to the big idea. Let other departments know you are willing and able to help them. Whether your customer is selling soap to the public, or is an engineer trying to get something across to a group of laymen, it's still a "pitch," an effort to comunicate. Anything you can do to help get the message across faster, more emphatically or understandably, is worth it. By Tom Martin, Dayton Tech Art Co.

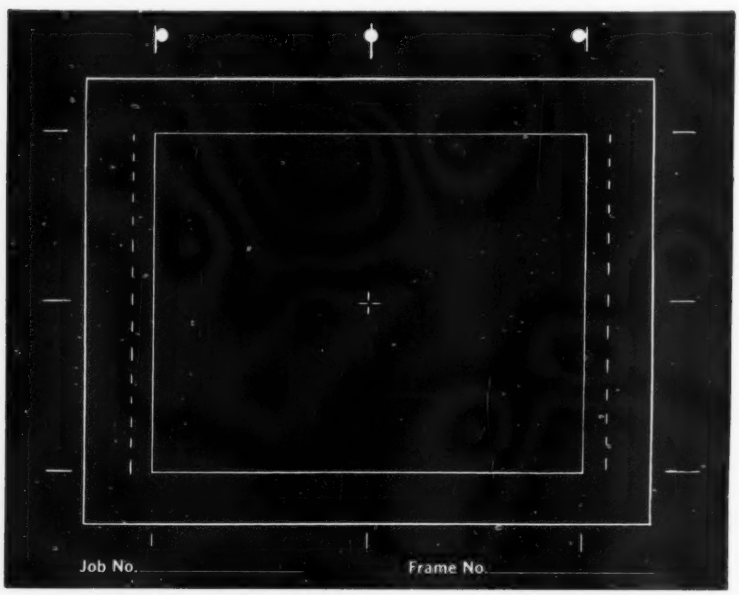

Figure 1

A Good Beginning

A good vehicle to spread the word about your interest in visuals—and one that may save you many painful hours over the camera trying to squeeze the subject into the screen format—is to prepare a standard frame for film art. Make a line drawing to scale, shoot a high contrast negative, and circulate film positives or diazos to your customers. It will show them your preferred size for art (drawings, charts, typewritten messages, etc.) and, whether they like it or not, the exact ratios of height to width for standard slide mounts and filmstrip projector apertures. **FIG. 1** shows our recommended standard. The outer, heavy line is the area to be covered with background paper. It gives you some room to work. The inner solid line indicates limits for an image to be shown in a single-frame projector, and the dotted vertical lines indicate limits for material to be shown via standard double frame 2 x 2-in. slides. It is a good idea to show center lines as well for a reason we will cover later. Be sure to stress the importance of maintaining *all* these ratios for larger or smaller material. At the same time, make it clear that you *prefer* original material to be made to this exact size. Why? Usually it is just as easy to work to this size as to any other and, more important, working to this size will help eliminate needless detail which would only confuse the viewer during projection.

How About Working Smaller?

As long as the ratio is maintained, no harm is done by working smaller, and that's why we suggest the center lines. Particularly with typed or printed messages, done to scale in the center of your frame, you get really good slides by moving in close with the camera, as shown in **FIG. 2b.** While you are looking at it, notice in the figure, how much more legible the "tight" copy is over the "loose" copy in **FIG. 2a.** Both illustrations are

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Legibility of projected copy is a function of the type height to screen height ratio.
Excessive white space on the art will waste valuable space on the screen.
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Figure 2a

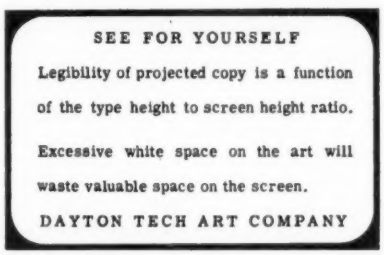
SEE FOR YOURSELF
Legibility of projected copy is a function of the type height to screen height ratio.
Excessive white space on the art will waste valuable space on the screen.
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Figure 2b

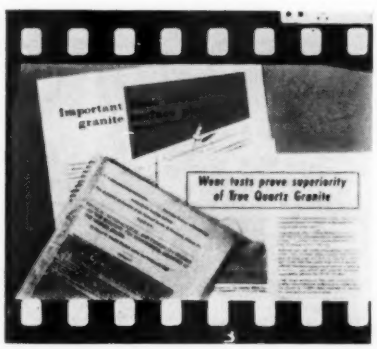


Figure 3

from IBM Bookface type. But, because the reduction ratio (in camera) was much less in the better version, each letter on the screen will occupy far more screen area. You pay a terrible premium to get copy from its source to the screen. Why waste all that valuable space? Artists who pride themselves on "white space" utilization have no business marking copy for projection! You might try a little (but tactful) re-education on this score.

Utilize Existing Material

Look around for existing material such as literature, reports, and other previously prepared materials which can be used "as is," or modified by the addition of color, or by simple cut-and-paste methods. You can frequently avoid the expense of new art in this manner. **FIG. 3** was used in a sales film to cover some important product features. **FIG. 4** was made by cutting an old safety poster and was used for comic relief in a talk to supervisors.

Swipe Movie Ideas & Techniques

Look to your cinematographic brethren (perhaps you're one yourself) for ideas to provide continuity and pace in your slide presentations. In a slide film made recently, we used a company official (a really nice guy) to introduce our subject. The remarks were interesting, but somewhat longer than you would care to look at a single picture. Therefore, we opened with a long shot and followed with a tight close-up as shown in **FIG. 5.** All this gave a feeling of having the audience "move in closer" to better see our speaker. To get a change of pace—for example after a series of charts or graphs—try to interject a cartoon or "live" shot, whichever carries the story idea better. We had used existing art from an automotive brake service manual to instruct service mechanics. The art was fine and it did a job. But art, after art, after art could have put at least a few guys to sleep (and

Figure 4

Figure 5a

Figure 5b

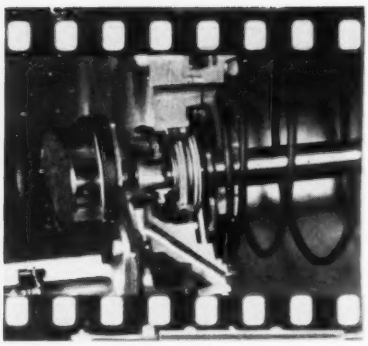


Figure 6

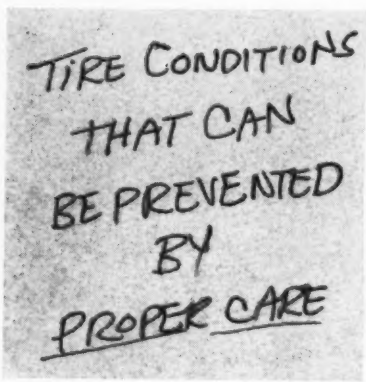


Figure 7

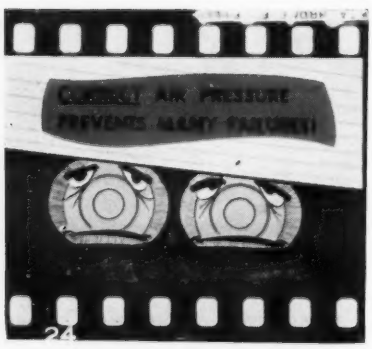


Figure 8

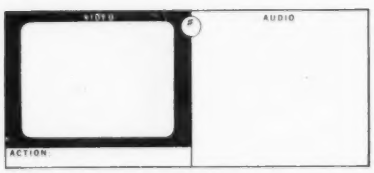


Figure 9

possibly put us out of business). **FIG. 6,** a good clean close-up of a real cut-away of the part under study, was used for change of pace. (It is reported that no sleepers were noticed at the showings.)

By all means work from a shooting script. It will save time, money and tempers all around. It doesn't have to be fancy if you are allowed some freedom of expression. **FIG. 7** shows a basic idea submitted by a customer with permission to "make it nice." **FIG. 8** shows our version, which the customer thought was nice enough. Where you must get multiple approvals—cases in which there are many fingers in the pie, and many people to please with the finished story—better use the story board illustrated in **FIG. 9.** Such items are available in both roll and sheet form at art supply houses. Have an artist render all proposed slides before you even touch a camera. Use these sketches for approval, and work from them when you begin shooting.

Keep It Simple

The whole purpose of putting something on the screen is to get an idea across. It is only logical that the more elements involved in any single frame, the less impact each can have on your audience. Compare **FIG. 10** with **FIG. 11.** It is much easier to remember the *single* figure, than to try remembering all *three* ideas covered in the more complex slide. Scientists and engineers seem to need the most persuasion on this score. They want, and often actually need, considerable data on one frame. The only solution is to help them break it up into smaller pieces and show them how it can be simplified by adding more slides to the sequence.

Make It Interesting

In a story introducing a new catalog system, the script called for a close-up of the catalog—a rather deadly subject pictorially. Since the story was about user benefits, we used a dummy catalog in a table-top shot showing the catalog as the user would see it. **FIG. 12** shows the result much more vividly than a flat picture of the book alone.

Eliminate The Unnecessary

Many speakers, particularly our science and engineering friends, like to "have it *all* up there on the screen." One guy, when asked

Figure 10

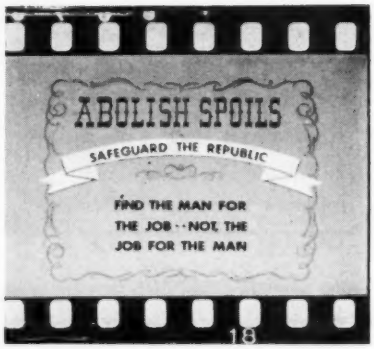


Figure 11

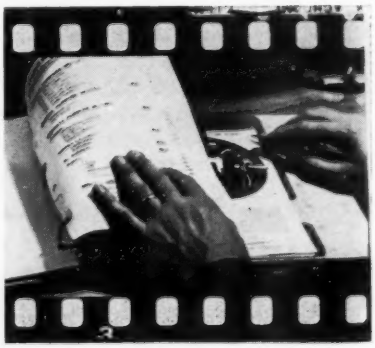


Figure 12

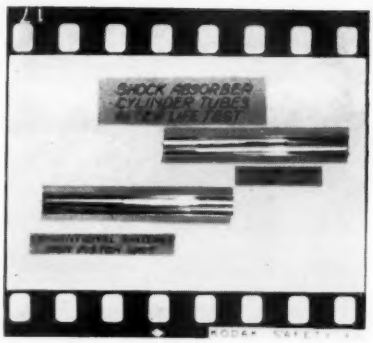


Figure 13

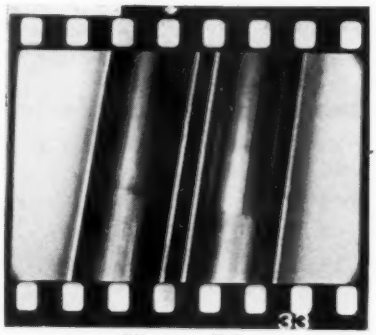


Figure 14

Figure 15a

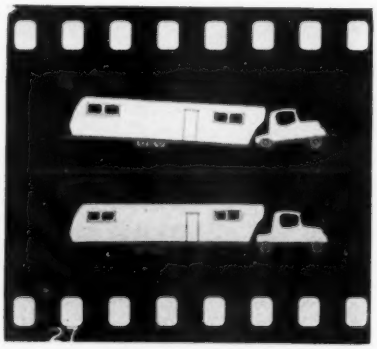


Figure 15b

"Why?" replied, "I like to read off the data." Well, that's the way the light beam bounces some days. However, with some persuasion from you, these guys can be convinced that details can be heard (from the speaker, tape or record) and that more emphasis can be given the pictorial crux of subject on the screen. **FIG. 13** was an attempt to show wear on parts (complete with many titles). **FIG. 14** is the revision that "speaks for itself" without lettering.

Add Emphasis For Clarity

Sometimes photographic realism leaves something to be desired. We hate to admit this but, again, we must be honest with you. Here's a case, **FIG. 15,** which shows how a diagramatic figure was shown following a location shot to hammer home the evils of the "low" trailer hitch which overloads tires and stuff. Cost more for extra art? Sure, but how much would it cost if the point failed to get through to the service mechanics who are given this pitch?

Where To Get Art

If your company has an art department, chances are you have worked out the fine details of proper screen art with them. If you do not have such a department, by all means use a source which has experience in slide film art preparation! The art should be bold and attractive without overcoming the point to be made. Color Vue and Color Aid papers do a fine job, but you should run color sets to find out exactly how each of the many hues and intensities will reproduce under your conditions. **FIG. 16** illustrates use of type on an acetate (cell, to the movie guys) overlay, and **FIG. 17** shows lettering done with a Varigraph machine. You will also find ceramic letters and plastic letters very useful where copy can be held to a minimum. Generally, backgrounds of a lower value than the important parts of the illustration and copy are to be preferred. White backgrounds—which give the audience a peachy view of the screen—are to be avoided like the plague of hypo dust in your film storage room.

A Word About Equipment

With the exception of specialized cameras used to shoot master filmstrips, practically any industrial photographic equipment may be used to prepare visuals for projection. The

(*Continued on page* 51)

Figure 16

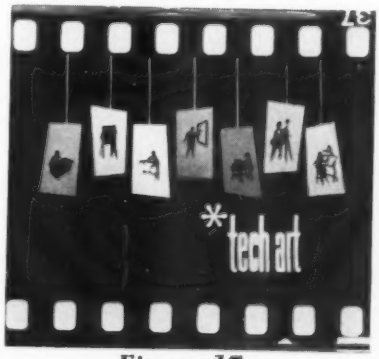
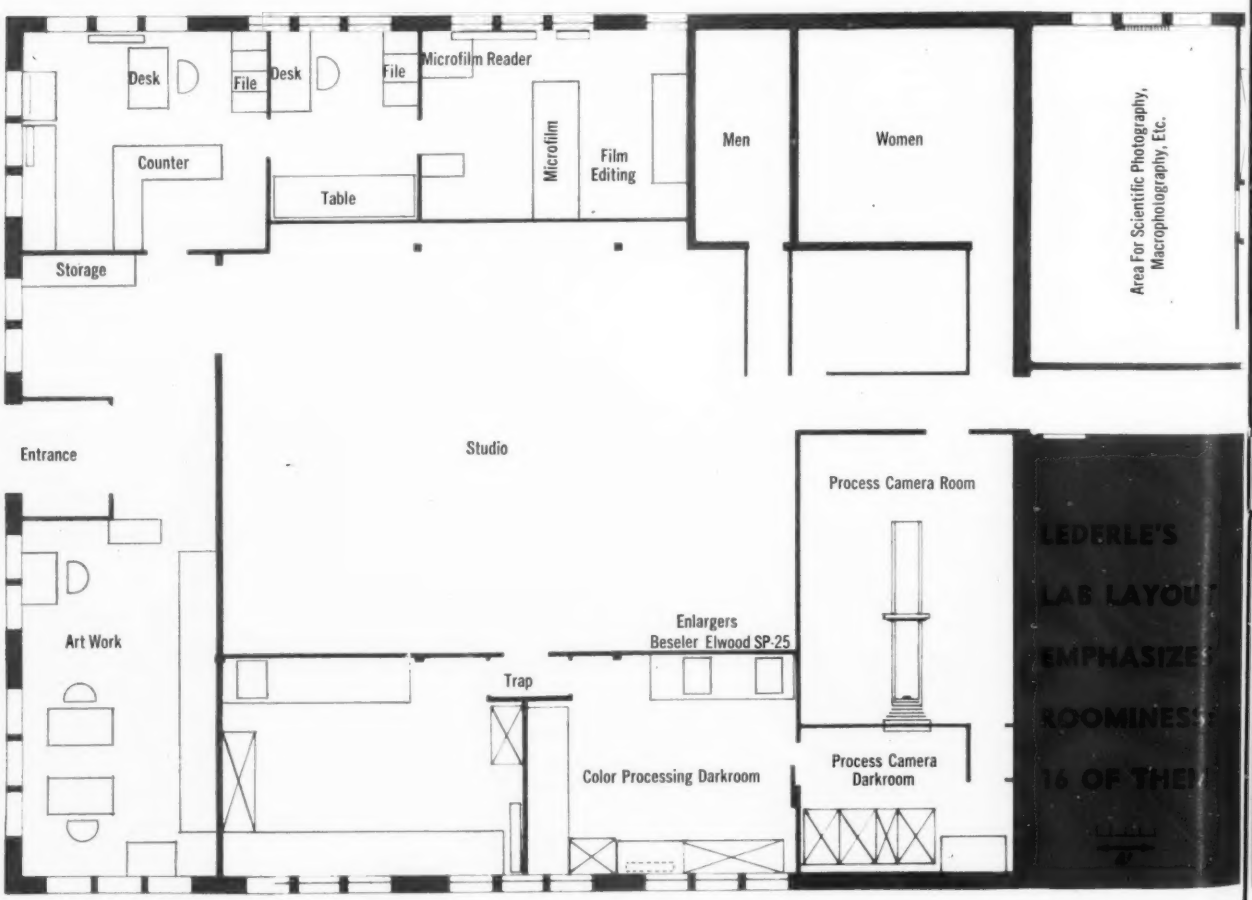


Figure 17

PHOTO DEPARTMENT ANALYSIS NO. 12

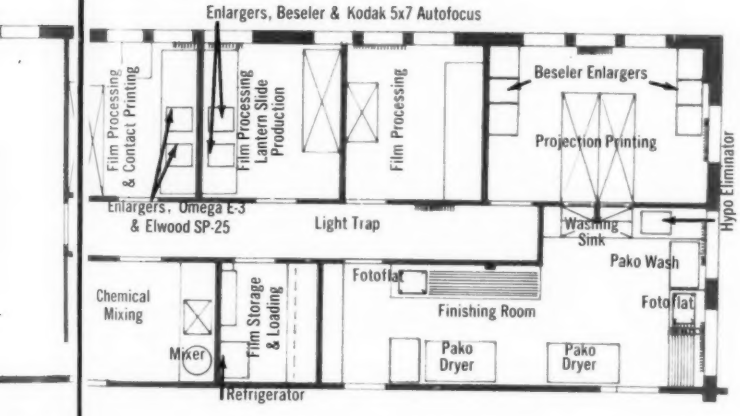
LEDERLE LABORATORIES

This three-ring photographic circus up the Hudson from New York features a fascinating array of pictorial virtuoso operations—from stills of pills to full color films—in a pleasant modern plant with its own trolley cars.



"On paper, 16 rooms looks like plenty for 11 people," says Les McWilliam, Head of Photographic Services at the Lederle Laboratories Division of the American Cyanamid Company. "But we could use more space." The photo department at the city-size (5000 employees) Lederle plant at Pearl River, N.Y. is as important as any other production or research tool—and has a hand in just about everything from medical research to the actual business of bottling vitamin pills.

Housed in a comfortable layout in one of the many Lederle buildings, the 11-man photo team is geared to meet almost any demand on its time, talent and equipment. Due to the nature of the Lederle business, the photo department functions primarily as a service to research—shooting experiments and their results, photomicrographs of stains and smears—and preparation of charts, graphs and action curves for reproduction in monthly reports. However, under McWilliam's supervision they also handle such diversified assignments as microfilming, community service and internal education motion pictures, motion analysis, news pictures (they can do a superspeed job when it's necessary), promotion and product shots, print and slide material for sales and public relations personnel, an employee portrait file, photographing the twelve-thousand annual visitors (who are transported around the sprawling Lederle plant in gaily colored trams), photo displays, preparation of line and half-tone negatives for offset—to name a few. McWilliam wishes they might also make the offset plates that they require—in order to get better quality control. Also operated by the versatile Lederle photo department is a projector servce.



Tribute to the efficiency of the Lederle photo lab is the apparent ease with which it turns out 3000-5000 quality black-and-white prints a month —and a large number of color transparences. The department does all its own processing, with the exception of microfilm and color motion picture film, in air-conditioned darkrooms. (They *do* have emergency equipment to handle motion picture film—just in case research demands the footage "yesterday.")

Standardizing on materials has simplified the processing operation. Since most of their black-and-white photography is by available light, logical film choices are Kodak Tri-X and Ansco Super Hypan, both exposed according to manufacturer's recommendations. Tri-X is developed in D-76, Super Hypan in Permadol, and all prints made on Polycontrast paper (generally nothing larger than 11 x 14, although they once made a circular print 6 ft. in diameter for the Brussels Fair—by making two prints on 40-in. paper and piecing them together).

Anscochrome color is used for both still and motion pictures. Prints for display purposes are made on Ansco Printon.

The size of the photo lab layout made it necessary to decentralize supplies, and all materials are stored conveniently near the area where they will be used. Film, however, is kept in one place—the refrigerator (which also contained two bottles of coke, last time we looked). There is an additional reserve supply of film in cold storage downstairs.

Although motion pictures aren't the major part of the Lederle photo operation, they are an increasingly important one. Aside from community service films—one is now being made for the Rockland County Boy Scouts—there are constant requests for lecture material and for short films for the Lederle internal education program. In a plant large enough to be practically self-sufficient (it even maintains its own road building crew), there is considerable danger that one department may never be acquainted with the function of the others

or even, in some cases, aware of their existence. Motion pictures provide a graphic means of introducing the various plant operations and showing how the internal gears mesh.

McWilliam is proud of the fact that his staff has never interfered with other employees whom they are photographing. A far cry, he says, from the outside crew who once came in, spent three weeks underfoot to make a half-hour film, and presented the company with a great big bill. Some time later the McWilliam crew turned out three sound films in color with a total running time of 1¼ hours—for much less money. He had simple arithmetic on his side to prove that even if it's necessary to buy additional equipment to do a particular job, it's cheaper in the long run (and often even in the short one) to have it done by his department than to turn it over to outsiders.

The photo lab is rarely called upon for high-speed motion analysis studies, but when it is, McWilliam finds that 64 fps is fast enough for most purposes. However, he did once borrow a Fastax to analyze a capsule counting machine which had developed a decided neurosis.

How does McWilliam get new equipment—if he needs it? Orders it. Or has it built to order. Case in point: He designed a temperature control water jacket for color processing and had it built by one of the departments on the premises. It utilizes a recirculation system which represents a considerable saving on the company's water bill. A not inconsiderable talking point come the next time he wants a new piece of equipment.

Currently he is having a new film cleaning machine built to his specification. Dissatisfied with available types which often played havoc with important footage, he dreamed up a new one. Film will no longer be run through an increasingly dirty solution, but will be mechanically sprayed on both sides with cleaner. The cleaner runs off to be filtered and re-used. The new machine won't have rubber squeegees—instead air jets will do the drying. Film then passes over buffers and directly to a powered take-up reel, eliminating the need for friction drive. A timing device, controlled by build-up of film on the take-up keeps rate of film movement constant.

Equipment which the Lederle photo department already has at its disposal leaves little to be desired. Three 4 x 5 Graphics—one Speed and two Crowns—plus a single-track Press Linhof 4 x 5 see a lot of service on general and public relations assignments, as well as for field and studio research. So do a Hasselblad and a 3.5 Rollei. There are six Exaktas—four of them (*continued on page 67*)

LEDERLE LABS'

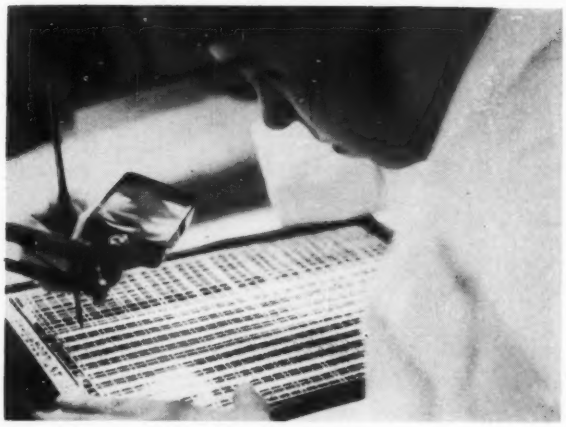
Les McWilliam heads many-faceted photo lab operation. Marilyn De Palma, Photo Secretary, at right.

Ed Bollinger, five-man general photo team leader, shoots giant pill bottle for Drug Trade Press story.

Emil Syko, Jr. (who spends a lot of time in the darkroom) loads auto contact printer for heavy order

PHOTO STAFF - - FULL OF VITAMINS

Phil Haub and Hasselblad cover installation of electronic computing equipment at Lederle Labs



Patricia Lindemann opaques line negative. Not pictured: art men Walter Hearn, Winnie Erikson.

Emil Syko, Jr., part of Bollinger team, covers outside assignment for Accident Prevention Dept.

Frank Czarnecki, Beginner Photographer, operates Kodak Model 25 projector as part of A-V service.

Gene Becker, the man with the ATF process camera, turns out line, halftone negatives for offset.

Photomicrographs are part of photo department activity. Research Photog Bob Wood is the expert.

HIGH-SPEED CINE CAMERAS

Ordinary cine cameras are valuable tools, but when it comes to high-speed motion analysis, you need a job with more get-up-and-go. These cameras have it.

Capable of operating speeds to 18,000 pictures per second, the cameras listed here can spot design weaknesses in test models, follow the trajectory of high-speed objects in motion, expose the need for safety devices, fulfill hundreds of other industrial assignments. An intermittent light source provides the shuttering action (with most of these it's a rotating prism or mirror synchronized with continuously traveling film). Pictures per second speed can be varied by modifying the applied voltage.

Where speeds in excess of 18,000 pps are required, it's necessary to choose a camera from one of three other categories:

1. Drum type. This one is synchronized with a pulsing light source capable of flashing up to about 50,000 per second. Because no rotating prism or other optics are required between camera lens and film, there is potentially a greater resolution possible than with other systems. A format as large as 24 x 36mm is possible at 6000 pps, decreasing to approximately 2 x 35mm at the top speed of 50,000 pps.

2. Image Dissecting type. Takes up to 300 pictures on one 4 x 5-in. plate at speeds to 150,000 pps. A special design utilizing this principle has just been evaluated permitting up to 2000 pictures at speeds in excess of 1,000,000 pps.

3. Streak type. Capable of speeds to 4,000,000 pps, but with a very limited number of pictures (approximately 20) possible per sequence, and with a lower order of resolution than is possible with the other two systems described.

J. A. Maurer, Inc. and Beckman & Whitley handle equipment in this ultra-high-speed field.

For further information about any of these cameras, look for the boldface number under "Notes" then circle the corresponding number on the Readers' Service Card, page 59. The number for J. A. Maurer, Inc. is 139, for Beckman & Whitley, 138.

CAMERA	FRAME	MAX. FILM LOAD	SPEEDS (PPS)	VIEWING/FOCUSING	MOTOR	WEIGHT*	PRICE**	NOTES
Kodak High Speed Camera	16mm full	100 ft.	1000-3200	View and focusing finder combined. Viewfinder position covers full taking lens image at film aperture. Magnifying eyepiece provides critical "through-lens" focusing on matte-surface focusing leader	Built-in universal motor operates on 115-V AC or DC, 30 amps to start, 18 amps to run	32 lbs.	$1713.50	E.K. "S" lens mount; ¼W argon lamp timing light flashes 120 times/sec. when connected to 60 cycles; starting switch in power cord; motor cut-off switch set before run at 50 or 100 ft., depending on film supply; synchronous controls permit opening or closing of an external circuit at any time during camera run. 142†
HS-16B	16mm full or 16mm double (choice of one)	200 ft.	100-400 With high speed motor (16-64 with low speed motor)	Boresight (full frame magnified reflex viewfinder) available as accessory	28-V DC 7amps. 115-V AC 400 cycle motors available	8½ lbs.	$2600 (Lens, viewing/focusing apparatus, timing light extra)	"C" lens mount; remote control on/off; intermittent type movement; available as accessories: 400 and 1000-ft. film magazines, heaters, correlation pulse at apex of shutter opening, fiducial marks, interchangeable shutters, speed change gears, fan speed motor, timing lights. 140†
Vinten HS-300	35mm full frame	400 ft.	100-300 (24-300 with accessories)	Full frame magnified reflex viewer/finder —twin-lens reflex system	12-V DC, 70 amps or 24-V DC, 25 amps	75 lbs.	$7500	Special interchangeable lens mount; intermittent recording system pin register movement; neon timing light; available as accessories 1000-ft. film magazines, special AC motors. 141†

HS-16B	16mm full or 16mm double *(choice of one)*	200 ft.	speed motor *(16-64 with low speed motor)*	*(Iron frame magnified reflex viewfinder)* available as accessory	115-V AC. 400 cycle motors available	8½ lbs.	*ing/focusing apparatus, timing light extra)*	correlation pulse at apex of shutter opening, fiducial marks, interchangeable shutters, speed change gears, low speed motor, timing lights. 140†
Vinten HS-300	35mm full frame	400 ft.	100-300 *(24-300 with accessories)*	Full frame magnified reflex viewer/finder —twin-lens reflex system	12-V DC, 70 amps or 24-V DC, 25 amps	75 lbs.	$7500	Special interchangeable lens mount; intermittent recording system pin register movement; neon timing light; available as accessories 1000-ft. film magazines, special AC motors. 141†
[redacted]								
Zeiss Ikon ZLI	18 x 22mm or 9 x 22mm on 35mm film	150 ft.	250-2000 *(18 x 22) or 500-4000 (9 x 22)*	Parallax-correcting interchangeable lens telescopic viewfinder for rough adjustment and for viewing during exposure; 5X focusing magnifier	220/380-V 3-phase motor. 7.5 amps approx.	770 lbs. complete *(incl. power supply, tripod, etc.)*	To 6000 pps, $21,500; 6000-40,000 pps, $22,700	Two lenses: built-in 45mm f/2 reproducing lens; second lens either 45mm f/2 or 360mm f/2.8; two timing lights; built-in heating system controlled by thermo-switch; 3 sets of interchangeable driving disks permit adjustment to 6 different frequency gradations; push-button switch for interrupting motor circuit and coupling current; accessory mirror crowns permit speeds to 40,000 pps; can be adapted for use in micro-cinematography. 143†
[redacted]								
Model HS100 *(Airborne Model)*	16mm full	100 ft.	16-2200 *(depending on motor)*	Full-frame open sight viewfinder, parallax corrected, and boresight viewfinder for critical focusing	Standard motor provides 80-1000 pps; others enable speeds 16-2500 pps. All 28-V DC	11 lbs.	$1330	Special bayonet lens mount; nylon brake; stop-start switch inc. in camera with film run-out switch; uses any 16mm film; made for operation under high "G" loadings; boresight viewfinders for through-lens focusing available. 144†
Model HS101 *(Industrial Model)*	16mm full	100 ft.	16-8000 *(depending on motor)*	As Above	Standard motor provides 200-2000 pps; others enable speeds 16-3500 pps. All 28-V DC operation, .6-16 amps depending on motor. Dual-motor kit provides 1000-8000 pps. 60-V required for top speeds.	10 lbs.	$1395	Special bayonet lens mount; nylon brake, medium speeds; magnetic brake, highest speeds; magnetic brake and dynamic braking; uses any 16mm film; boresight viewfinders for through-lens focusing available. 145†
Model HS108	8mm full or 16mm half	100 ft.	32-16,000	As Above	Same as HS101 except twice picture taking rate attained for each applied voltage	10 lbs.	$1895	Same as above, except double-perforated 16mm film must be used for 8mm format. 146†
Model HS116	Quarter frame 16-mm	100 ft.	64-32,000	As Above	Same as HS101 except four times picture taking rate attained for each applied voltage	16 lbs.	$4975 *(including high-speed motor kit)*	Same as Model HS101 above. 147†
Model HS401	16mm full	400 ft.	25-6000	As Above	Standard motor provides 450-2200 pps; others enable speeds 25-2500 pps. All 28-V DC operation. Dual-motor kit provides 2500-8000 pps. 60-V required for top speeds. 30-135 amps	24 lbs.	$2670	Special bayonet lens mount; magnetic brake; stop-start operation at all speeds; uses any 16mm film; two timing lights standard; boresight viewfinders for through-lens focusing available. 148†
Model HS408	8mm full or 16mm half	400 ft.	50-16,000	As Above	Same as HS401 except twice picture taking rate attained for each voltage	24 lbs.	$3170	Same as above except double-perforated 16mm film must be used for 8mm format. 149†
Model HS416	Quarter frame 16-mm	400 ft.	100-32,000	As Above	Same as HS401 except four times picture taking rate attained for each applied voltage	30 lbs.	$6,005 *(including high-speed motor kit)*	Same as Model HS401 above. 150†

Continued Overleaf ↓

**Exclusive of power supply and film load. **Including lens, motor, viewing and focusing apparatus, timing light, case, cords and plugs—unless otherwise specified.*
†Reader's Service No.; for more information, circle the corresponding number on card attached to page 59.

CAMERA	FRAME	MAX. FILM LOAD	SPEEDS (PPS)	VIEWING/ FOCUSING	MOTOR	WEIGHT*	PRICE**	NOTES
16mm-1A	16mm full	100 ft.	300	Boresight tool for critical focusing or full aperture viewing available as accessory	24-V DC	20 lbs.	$7000 *(lens, viewing/focusing apparatus, timing light, case extra)*	Special interchangeable lens mount; buckle switch, run-out switch footage counter standard equipment; two-light timer available; motor brings camera to speed in less than 1 sec.; camera stops in 2 sec. when power cut; intermittent film movement with dual pull-down arms, positive registration pins; designed to withstand acceleration load of 50 "G's". 151†
16mm-1B	16mm full	1200 ft.	12-1000	Boresight tool, 20X magnified full frame through-lens viewer and focuser available as accessory	24-V DC motor, 6-48-V DC, 1-8.5 amps	9 lbs.	$1300 *(lens, viewing/focusing apparatus extra)*	Special High-G 4-screw lens mount; rotary disc shutter between film plane and prism; heater; 3 sets reduction gears, two timing lights, 100-ft. daylight loading magazine, carrying case, standard equipment; start-stop for runs of less than magazine capacity; designed to withstand acceleration load of 100 "G's". 152†
16mm-1C	16mm full	400 ft.	To 4000	Reflex viewer available as accessory	24-28-V DC	32 lbs.	$5,500 *(lens, viewing/focusing apparatus extra)*	Camera may be mounted in any position relative to acceleration forces. Entire film load used in one run. Has rotary disc shutter between film plane and prism. Standard equipment includes 400 ft. mag., buckle switch, runout switch, two timing lights, heater and carrying case. 153†
35mm-4B	35mm full	1000 ft.	250-2800	Full-frame 10X boresight for through-lens viewing and focusing	All types available. When 208-V AC, 3-phase synchronous drive motor used, 7-8 amps needed for 500-2500 pps. 208-V DC take-up motor to 15 amps	80 lbs.	$7400 *(lens, motor extra)*	Hasselblad lens mount; rotary disc shutter between film plane and prism; two timing lights, two fiducial lights, control box and cable, 10X viewer, take-up motor, automatic power cut-off for end of film or in event of film buckle, standard equipment; optional: simple gear shift lever for 500, 1000, 1500, 2000 and 2500 pps synchronous speeds. 154†
70mm-1A	.218 x 2.25 in.	80 ft.	100-400	Removable 10X boresight tool available as accessory	24-V DC or 110-V AC	30 lbs.	$6000 *(viewing/focusing apparatus, timing lights, case extra)*	Cast aluminum camera body; film is advanced by intermittent movement and is stationary during exposure. Film spools and transport mechanism packaged within the space enclosed by the shutter drum for compactness. Has built-in buckle switch. 155†
70mm-1B	.218 x 2.218 in.	1000 ft.	100-400	As Above	Series, 110-V AC	85 lbs.	$8000 *(viewing/focusing apparatus, timing lights, case extra)*	Film movement is intermittent type with dual pull-down arms; film registration pins located on aperture center-line; built-in buckle switch and re-settable footage counter. 156†
[redacted]								
Fastair FA-16	16mm full	50, 100 or 200 ft., depending on model	12-680 *(depending on motor)*	Accessory Fastair Finder Boresight available	Low speed motor, 12-32 pps, 12-26-V DC, .7-1.1 amps. Medium speed, 100-300 pps, 14-30-V DC, 2.5-3.5 amps. Hi speed, 350-680 pps, 16-28-V DC, 7-8.5 amps	8 lbs.	$1295 *(viewing/focusing apparatus extra)*	Fastair High G-Load lens mount; operates under acceleration loads up to 100 "G's"; built-in heaters; flat speed curve; reaches top speed in less than 3 ft. of film; can be started or stopped any time during film run; NE 2a Neon Glow timing light; built-in timing marker generator available as accessory. 157†
Fastax WF1	8mm single or double width on 16mm film with 8mm perforations	100 ft.	300-16,000	Integral viewfinder for true field size. Critical focusing through camera aperture	Two motors *(115-V AC-DC 60 cycle)* One for drive, one for take-up. 8-28-V DC, 2.3-3 amps, or 30-280-V AC, 3-11 amps	25 lbs.	$1795	FX1 Fastax Bayonet lens mount; cut-off switch automatically cuts power at end of film run; timing light provides 120 "pips" per sec. on 60-cycle current, or 100-1000 on Timing Light Generator available as accessory; provision for use of slit aperture masks to give shutter speeds to 1/800,000 sec. 158†
Fastax WF2	As Above	400 ft.	700-18,000	As Above	Two motors *(115-V AC-DC 60 cycle)* One for drive, one for take-up. 12-28-V DC, 2.4-3 amps, or 35-280-V AC, 2.5-16 amps	38 lbs.	$3000	Same as above, plus double timing light installed as standard equipment—one to indicate pps, one to indicate zero time. 159†

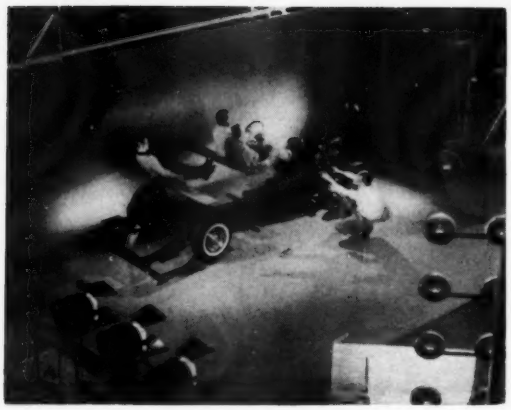
					amps			
Fastax WF2	As Above	400 ft.	700-18,000	As Above	Two motors *(115-V AC-DC 60 cycle)* One for drive, one for take-up. 12-28-V DC, 2.4-3 amps, or 35-280-V AC, 2.5-16 amps	38 lbs.	$3000	Same as above, plus double timing light installed as standard equipment—one to indicate pps, one to indicate zero time. 159†
Fastax WF3	16mm full	100 ft.	150-8000	As Above	Same as WF1	25 lbs.	$1795	Same as noted for WF1, except Powerstat, Type 116 supplied as standard equipment; variable range 0-135 volts AC to be used if sync between event and camera not required, and whenever max. camera speeds not necessary. 160†
Fastax WF3T	16mm full	100 ft.	150-6000	As Above	Two motors *(115-V 60 cycle. Maximum voltage 230 AC)*	25 lbs.	On request	Identical to WF3, except has 2-sided prism shutter for better frame coverage and picture quality. Available on special order. 161†
Fastax WF4	16mm full	400 ft.	350-9000	As Above	Same as WF2	38 lbs.	$3000	Same as noted for WF2. 162†
Fastax WF4S	16mm full	400 ft.	350-9000	As Above	Same as WF2	45 lbs. approx.	On request	Identical to WF4 except also has stop-start provision, permitting multiple runs on 400-ft. roll; operable at any frame rate; dynamic braking on drive motor-prism shaft assembly; synchronized magnetic braking on feed spindle and take-up motor. 163†
Fastax WF5	35mm half	100 ft.	100-6000	Integral viewfinder plus Removable Reflex Finder *(Type I)* Critical focus through camera aperture	Two motors *(115-V AC-DC 60 cycle)* One for drive, one for take-up. 8-30-V DC, 2.3-3 amps, or 30-280-V AC, 2.5-13.5 amps	29 lbs.	$2850	Same as noted for WF1—provision for slit aperture masks not provided except on special order. 164†
Fastax WF8	35mm full	500 ft.	200-2500	Removable reflex telescopic finder. Critical focus through camera aperture	Two motors *(115-V AC-DC 60 cycle)* One for drive, one for take-up. 10-30-V DC, 3-5 amps, or 35-200-V AC, 3.5-19 amps	62 lbs.	$8500	Same as noted for WF2. 800-ft. spools available on special order. Fastax WF8A, a modification of WF8 designed for rocket sled track recording, also available on special order. 165†
Fastax WF9	35mm half. Picture area covers ½ frame, oscillographic trace image the other half	100 ft.	100-6000	Removable Reflex Finder *(Type II)* Focus by using double focusing scale on lens	Same as WF5	29 lbs.	$3000	Primarily intended for recording electronic data simultaneously with picture; two lenses furnished: a 50mm on front of camera to record picture image, a 35mm on camera door to record osillographic trace; focusing 35mm lens done by direct measurement from camera to screen. Other specs same as noted for WF1. 253†
Fastax WF14	16mm full	400 ft.	650-8000	Removable finder for critical focus and Removable Reflex Finder *(Type III)*, to focus oscillographic trace	Two motors *(115-V AC-DC 60 cycle)* One for drive, one for take-up. 16-28-V DC, 2.5-3 amps, or 35-280-V AC, 2.5-16 amps	38 lbs.	$3750	Combined motion picture and superimposed oscillographic camera; two lenses furnished: a 50mm on front of camera to record picture image, a 35mm on camera door to record oscillographic trace simultaneously. Other specs same as noted for WF2. 254†
Fastax WF15	8mm single or double width on 16mm film with 8mm perforations	400 ft.	1300-16,000	As Above	As Above	38 lbs.	$3750	Same as above. 255†
Fastax WF17	16mm full	100 ft.	150-8000	Integral finder for critical picture focus and Removable Reflex Finder *(Type III)* to focus oscillographic trace	Two motors *(115-V AC-DC 60 cycle)* One for drive, one for take-up. 8-28-V DC, 2.3-3 amps, or 30-280-V AC, 2.5-16 amps	25 lbs.	$2250	Combined motion picture and superimposed oscillographic camera; two 50mm lenses furnished: one on front of camera to record picture image, the other on camera door to record oscillographic trace simultaneously. Other specs same as noted for WF1. 256†
Fastax WF21	Same as WF-15	100 ft.	300-16,000	As Above	As Above	25 lbs.	$2250	Same as above. 257†

**Exclusive of power supply and film load. **Including lens, motor, viewing and focusing apparatus, timing light, case, cords and plugs—unless otherwise specified.*
†Reader's Service No.; for more information, circle the corresponding number on card attached to page 59.

PORTFOLIO NO.11

Walter Farynk, General Motors Photographic, "will do anything to make a picture," strives for perfection by making each one better than the last

"I don't know too much about photographic rules. I don't really go too deeply into what I'm photographing. The picture is the important thing, and I'll do anything to make a picture," says crack General Motors photographer Walter Farynk. Energetic, resourceful, imaginative Farynk is a man devoted to the industrial picture—and to making each one the best damn photograph anybody's ever done on the subject. If he feels it's necessary, he's not the least shy about spending hours to set up a shot. He can spare little patience for photographers who alibi mediocre work by saying they were rushed. "Look," says Farynk, "if a picture's a knockout, nobody's going to ask how long it took to do it." Currently, about 90 per cent of his work is advertising illustration, much of it 8 x 10 color—"You never know when they're going to want a 24-sheet poster"—but he likes to "loosen up" with his Rollei or Leica as an antidote to ad staginess.

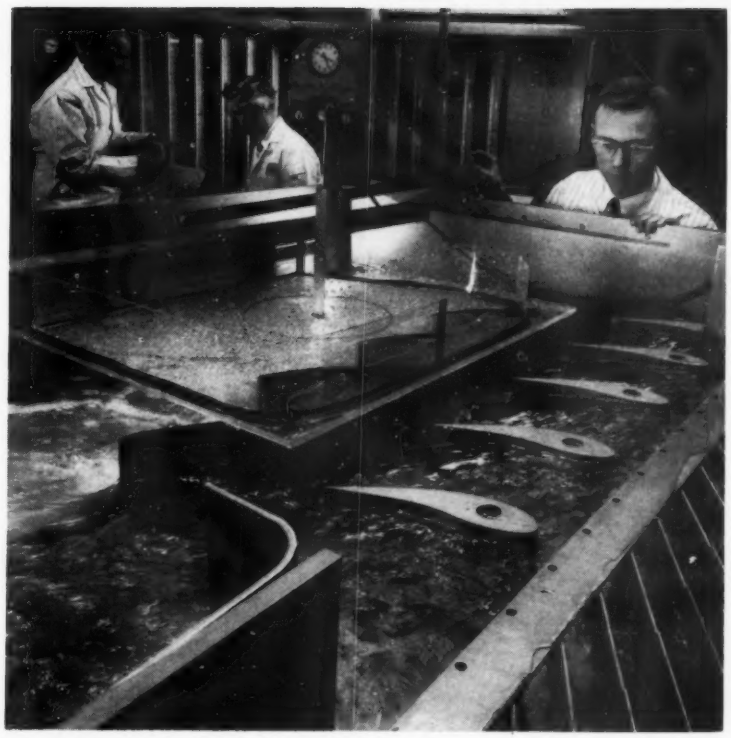


Put the people on boxes, said the art director when assigning the color illustration of GM's Air Ride *(below, left),* we'll retouch 'em out. Farynk considered this an affront to his ingenuity. Instead, had models sit on tines of a fork-lift truck protruding through no-seam paper. Lines that symbolize smoothness of the ride and bouncing of the wheels were set up on a transparency viewer, double exposed onto film later. Wavy ground is cardboard cutout put in bellows. Picture is on 8 x 10 Anscochrome. Did not require any retouching.

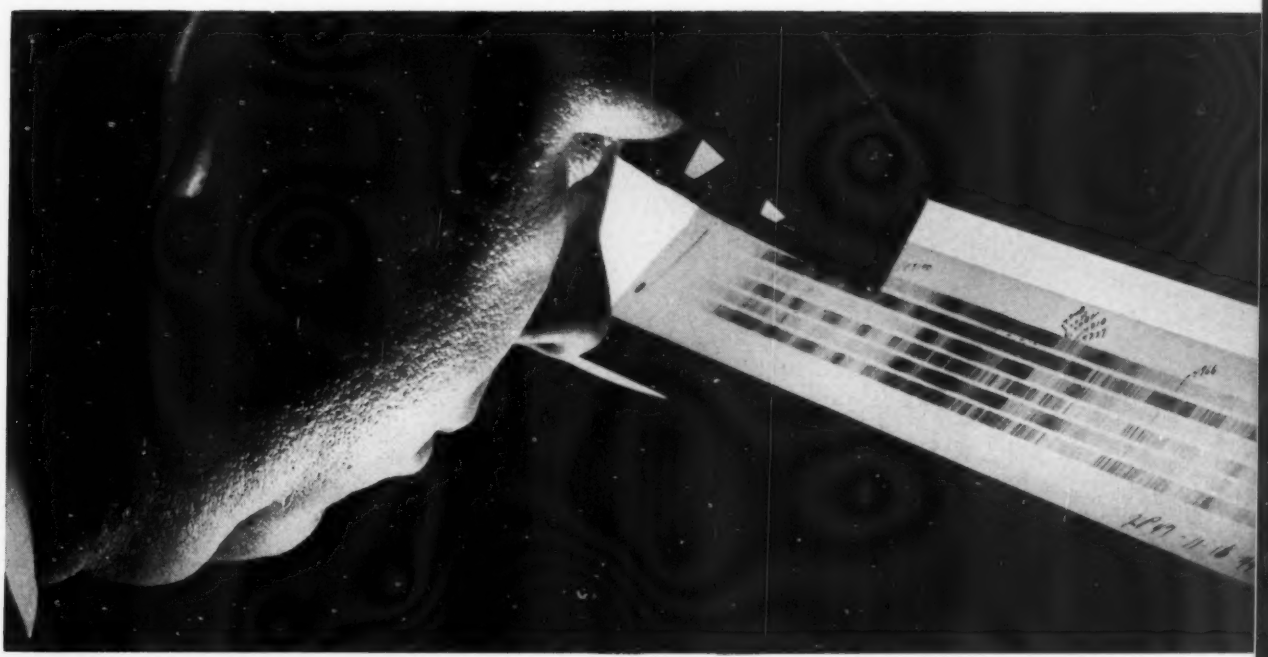
Ad for engineering magazines demanded a picture of the experimental X-300 auto being tried for its curve-taking ability on GM's test track. The appointed time was high noon. Farynk simplified things for himself by having the car stand stock-still, got all the elements in proper relationship in the ground glass, snapped the picture and left. The fun came later. Straight-down lighting didn't give Farynk enough play of blacks and whites, so he flashed print to edge of road. The motion blur? A trade secret. It was also used in picture at left.

Called to rescue, Farynk photographically untangled the maze of cylinders and circles that made up one of the late "Boss" Kettering's experiments in magnetism. Farynk avoided shadows by taping a concealed bare flashbulb wherever he felt it would aid plane separation.

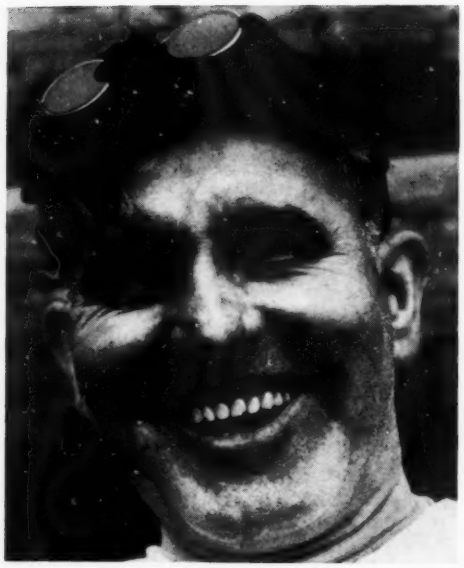
Lighting control is a Farynk forte. (At *right)* he first settled on composition with 8 x 10 view, then worked in flash reflectors for f/45 exposure on Ektacolor. No. 1 floods in reflectors pilot lighting, are replaced with flashbulbs. Men are engaged in study of vanes for hydraulic transmissions.



Make it look real is the guiding principle in Farynk's industrial pictures. The face of the spectrograph reader *(below)* is lighted by a flashbulb, aimed to simulate the direction of the light coming from the viewer. Subject held as still as he could during 3-sec. exposure to record spectrograph.



Million-volt X-ray machine *(below)* used to inspect a military tank. For some, Farynk says, the picture might seem contrived, forced and heavily lit. But, not only is it in character, it's a picture made to do a job—and it did the job to the satisfaction of all. Working with photoflood pilot lamps, Farynk masked his reflectors with 8½ x 11 white envelopes, torn to shape and attached with masking tape. Then he replaced the floods with flashbulbs. Flash technique includes overexposure and 30 percent under development.



Dull light, flashing smile portrait *(above)* was made as part of a "Men and Steel" series for a steel company. Comfortable for subject and photographer alike, diffuse north light in the shadow of a building models worker's face like a classical bronze. Animated subject or no, Farynk likes to fill entire negative with his count-the-hair-sharp images, did so in this Graflex shot.

Darker background *(right, above)* creates contrast for Bunsen flame, which normally is practically invisible. Farynk planted flashbulbs, shaded their light from walls and ceiling and made one second or so exposure to gain effect. This picture, again, is consciously handled with intense stage-like lighting to fit its purpose, an assignment for the Ethyl Corporation.

No 9 to 5 job, photography demands your thinking in photographic terms constantly, Farynk says. The Rollei portrait of GM-employed Detroit sculptor *(right)* is from a picture story Farynk did to get away from it all. Cigarette smoke takes free form of sculptor's work. Single electronic flash backlighting was necessary to show smoke, was only direct lighting in series.

RESOLUTION TESTS

Conflicting desires for speed, low cost, optical correction, resolution and other factors depending on application make every lens design essentially a compromise. How good is my lens? PMI is often asked. Here Bennett Sherman, Farrand Optical Co., project and research engineer, tells how you can get a reliable answer yourself with a minimum of equipment

Not the only, but one of the most important tests that lens manufacturers give their product involves photographing a series of resolution charts arranged on a frame so that they fill the entire image area of the camera size for which they're intended. As a single measure, nothing will inform the photographer more about lenses than a resolution test.

This article describes a method for adapting the precise resolution tests of the optical industry in such a way that they will provide a professional photographer with an accurate estimate of the comparative quality of lenses—with what I consider to be minimum effort. Applied to 4 x 5, 2¼ x 2¼ or 35mm cameras such a test will tell the photographer how two lenses compare in their lines-per-mm resolution, how "flat" is the field of a lens, how a lens increases or decreases in sharpness as it is "closed down," how accurately the focusing is calibrated—and how lens mount, lens board, holder and/or camera square up with the lens.

It must be said at the outset that the resolution tests to be described here have their limitations. As set up they apply only to ordinary picture-taking cameras of the formats described (they'd hardly do for testing the Palomar telescope, or even lenses for much less specialized applications). If done carelessly they are worse than useless. They will not tell you anything about color rendition, and little about the relative transmission or the many other qualities a lens should or must possess for your purposes. Figures you get from the tests are relative, not absolute. But they are quantitative—and they'll give you facts, not guesses.

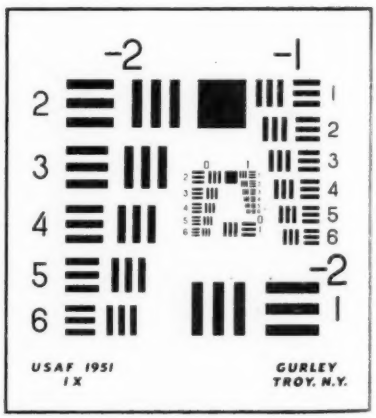
1 GETTING AND READING TEST

To make a resolution test, you need a set of test charts. There are many available. An excellent series is included in Bulletin No. 533, published by the U.S. National Bureau of Standards, Washington, D.C. A more recent, and in the opinion of many, a better chart was made for the U.S. Air Force (*below*). W. & L. E. Gurley Engineering and Scientific Instrument Co., Troy, N.Y. supply this chart as a glass plate (price: $75). The material in this article applies specifically to prints made from this chart. A set of 12 is needed for the test to be described is available from PMI's Readers' Service Department, 33 W. 60th St., New York 23, N.Y. The price is $1.

It's essential that you "read" the chart properly in order to derive information from the resolution tests. Here's how it's organized: There are four groups of test lines and each group is sub-divided into six pairs of three lines. The broadest lines are group 2, pair 1, lower right.

The finest lines are in group 1, pair 6, near the center of the chart. The order of the lines in diminishing size are as follows: Group 2, pairs 1, 2, 3, 4, 5, 6—group 0, pairs 1, 2, 3, 4, 5, 6—group 1, pairs 1, 2, 3, 4, 5, 6.

A note about storing the prints of the charts: Keep them flat!



2 ARRANGING THE CHARTS

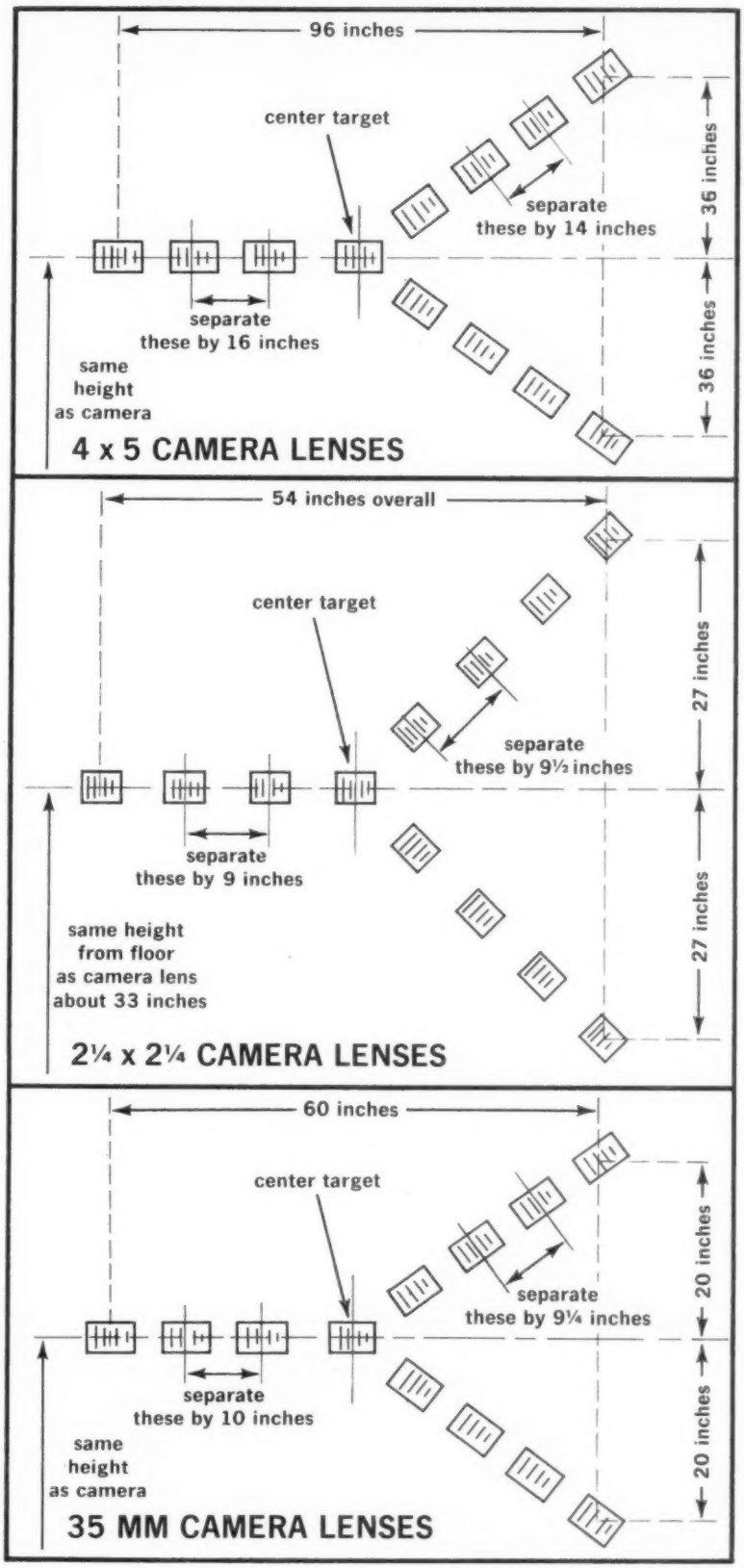
The idea in using the test charts is to cover as much as possible of the negative area. The diagrams at right will fulfill the requirement. Furthermore, they are scaled in such a way that you will be able to read the resolution of negatives directly in lines per millimeter without further measuring or mathematics. For this reason, tolerance of the dimensions given is only about an eighth of an inch.

But before setting up the charts, attention must be paid to the room in which the testing is to be done. A requirement is that you must be able to darken it completely, this so that exposures may be made by turning a light on and off rather than operating the shutter, to eliminate vibration. The room, of course, should be free of vibrations too. It also should be big enough to permit your backing far enough from the target—to test your longest lens—see tables, overleaf.

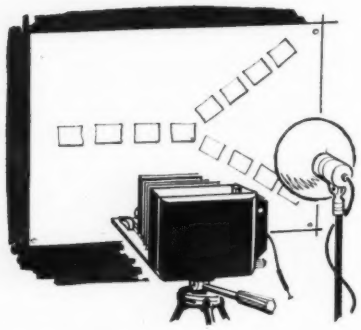
To determine the height above the floor for the targets, start off by positioning the camera. Your aim is to kill camera vibrations as much as possible. The surest way to do this is to put the camera on a tripod head and clamp the tripod head in the vise of a heavy work bench. Next best is to mount the camera on the sturdiest tripod available. If the tripod has an elevator, don't use the elevator. Be prepared to block the feet of the tripod. If the floor is smooth they may slip.

Once you've figured out how you're going to mount the camera, you'll have the height for placing the targets (*see diagram*). The center target is exactly the same distance from the floor as the axis of the lens, assuming the floor is level.

The test charts should be flat against the wall as possible.



3 SETTING UP EQUIPMENT



In making the exposures, the best method, as said previously, is not to use the camera shutter at all, but rather to turn a light on and off, using a low illumination level so that the exposures are long enough for accuracy.

For these reasons, I recommend your purchasing a 15-watt standard screw-base frosted bulb as the light source—and using it in a satin finish reflector to cut down on reflections.

The reflector should be positioned a foot or two above the camera and aimed carefully so that the chart receives as even illumination as possible.

Position the camera directly opposite the chart. It is not good to rely merely on one's eye for aligning camera and test charts. Use a spirit level to check on the horizontal and vertical planes, and measuring tapes to be sure that all lines and surfaces to be parallel are, in fact, parallel.

Although a lens test can actually be set up with a number of different film-developer combinations, I'd recommend reducing all the variables by settling on a fine-grain film, Kodak Panatomic-X, which is available in all the formats listed, and commonly available Microdol. It's unlikely that you'll find a camera lens with higher resolving power than the 120 to 150 lines per mm, of which this combination is capable.

4 PICK YOUR DISTANCE

The charts (*below*) list a number of prevalent focal length lenses for three formats popular with professional photographers.

They are worked out for use with the diagrams for chart placement on the previous page. If you match the camera-back-to-target-wall distance listed under the 4 x 5 format, for example, with the set-up for the 4 x 5 camera targets, you will ultimately be able to tell simply by looking at the finished negative through a magnifier how high its resolving power is.

If your lens is of a slightly different focal length than those listed specifically, you can figure out the correct test distance by interpolating between focal lengths. For instance if you are testing a 55mm lens for a 35mm camera, look between 50 and 58mm. The difference in distances is 8 in. The correct test distance for the 55mm lens must be greater than for the 50mm lens. To estimate how much greater take 58mm minus 50mm to get 8mm. Take 55mm minus 50mm to get 5mm. Five-eighths is the fraction you'll finally get. Five-eighths of 8 in. is the additional distance you'll need—5 in. Add this 5 in. to the 8 ft. 6 in. on the chart and you get your answer: 8 ft. 11 in.

If you prefer photography to algebra, just figure that if a lens you wish to test is not on the chart, but a longer and a shorter one are—the correct distance of camera back to target wall must fall between the distances listed. Your guess, though not as accurate as calculation, won't throw you off much.

In some cases, even if you are properly set up, the images of the test charts will not quite fill the negative area out to the edges—although in most cases the fit should be good.

Should you find this to be true, double-check your figures and your measurements to eliminate the possibility of mathematical error. If there are no errors, go ahead. As long as the center target is in dead sharp focus and on dead center, and your camera is parallel to the target—you can depend on results.

4 x 5

Focal Length	Distance—Target To Camera Back
127mm	8 ft. 10 in.
135mm	9 ft. 3 in.
150mm	10 ft. 4 in.
162mm	11 ft. 2 in.

2¼ x 2¼

Focal Length	Distance—Target To Camera Back
60mm	5 ft. 3 in.
75mm	6 ft. 6 in.
80mm	6 ft. 10 in.
105mm	8 ft. 11 in.
135mm	11 ft. 6 in.

35mm

Focal Length	Distance—Target To Camera Back
21mm	3 ft. 5 in.
28mm	4 ft. 7 in.
35mm	5 ft. 9 in.
45mm	7 ft. 2 in.
50mm	8 ft. 6 in.
58mm	9 ft. 2 in.
85mm	14 ft. 1 in.
90mm	14 ft. 11 in.
100mm	16 ft.
105mm	16 ft. 6 in.
125mm	19 ft. 8 in.
135mm	22 ft. 3 in.

5 MAKING THE EXPOSURE

EXP. NO.	f-STOP	EXPOSURE TIME
1	f/2	3 sec.
2	f/2.8	6 sec.
3	f/4	12 sec.
4	f/5.6	24 sec.
5	f/8	48 sec.
6	f/11	96 sec.
7	f/16	192 sec.
8	f/22	384 sec.
9	f/32	748 sec.
10	f/45	1496 sec.
11	f/64	2992 sec.

Listed here are a set of exposures necessary to see how the lens behaves at various f-stops. The set is based on the following data: A 15-watt bulb in a spun aluminum reflector placed 10 ft. from the target. Panatomic-X film at a user index of 40. The application of the reciprocity law.

If reciprocity law failure is taken into account, the ½-min. exposure times should be multiplied by two; and the one multiplied by three and so on.

I would suggest a couple of test exposures at either end of the scale to make sure you get even densities throughout.

The procedure I've used is to darken the room, and to work under a ruby safelight with its light shielded from the target. I insert the film, open the shutter, wait till the sweep second hand hits the top of the dial, then turn on the 15-watt bulb. When the required time is up, I turn the light off and close the shutter. If you want to see the effect of shutter jar on your camera, try a comparison test at 1/50 sec.

I suggest the following development procedure: Fresh Microdol at 68° F, with other solutions and wash water also at 68. Agitation 5 sec. every 30 sec. Any deviations will affect your results somewhat.

6 READING THE NEGATIVES

The diagram (*below*) illustrates what I consider a good system for examining the negatives.

Using an enlarger to make greatly magnified prints only introduces another possible error which has nothing to do with the camera or test itself.

Referring to the diagram, the desk lamp is pointed at the white blotter paper reflector, it should not, of course, shed any of its light on the top of the negatives.

It's impossible to do an accurate reading of the negatives if the film is not flat. If necessary hold down all but the part you are viewing with another piece of heavy glass.

Using the 20X magnifier is somewhat tricky. If necessary, shim it up with pieces of adhesive tape to get it in focus.

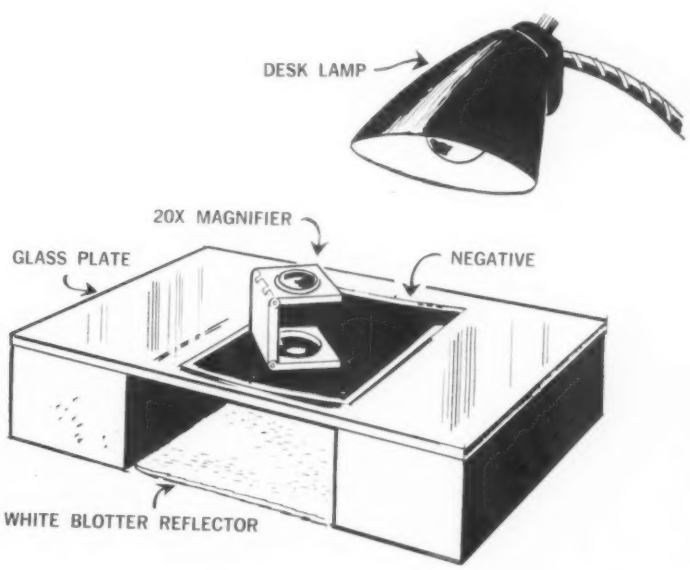
Then take a look at the first exposure. The large lines of the test charts should stand out quite clearly, particularly in the charts near the center of the negative. Look closely at the smaller pairs of lines. You will come to the last lines which you can actually distinguish—they are key. The smaller lines will be fused.

Naturally some judgment is involved here. It will take some time to get the hang of reading the lines properly, so I suggest some dry runs.

Because this part of the test is a bit subjective, it is a good idea for one person to do all the "reading."

In interpreting the results you get, remember that the usual lenses for larger cameras do not quite reach the high resolving powers of the miniature camera lenses, mainly because these larger camera lenses are of simpler design, contain more glass to correct and the requirement for very high enlargement is not so important—a 35mm negative enlarged to 20 x 30 is equivalent to enlarging a 4 x 5 negative to 80 x 100 in. A few lenses, such as the famous 7½-in. Kodak Aero Ektar f/2.5, and some specially made standard working lenses do give higher resolving powers, however.

At this juncture, it might be well to repeat that this test is intended for hand-camera lenses. Lenses for special purposes are out of the scope of this article.



7 DETERMINE RESOLUTION

4 x 5 CAMERA

GROUP	PAIR 1	2	3	4	5	6
–2	5	5½	6¼	7	8	9
–1	10	11	12½	14	16	18
0	20	22	25	28	32	36
1	40	44	50	56	64	72

Lines Per Millimeter

2¼ x 2¼ CAMERA

GROUP	MEMBER 1	2	3	4	5	6
–2	6¼	7	8	9	10	11
–1	12½	14	16	18	20	22
0	25	28	32	36	40	44
1	50	56	64	72	80	88

Lines Per Millimeter

35mm CAMERA

GROUP	PAIR 1	2	3	4	5	6
–2	12½	14	16	18	20	22
–1	25	28	32	36	40	44
0	50	56	64	72	80	88
1	100	112	128	144	160	176

Lines Per Millimeter

If you've followed the directions on how to put up the charts and how to position the camera in relation to them, the tables above will give you the resolution of your lens.

In each of the three tables there are 24 numbers corresponding to the 24 sets of lines on the test charts. You'll remember that on the targets the coarsest lines were those that comprise group 2, pair 1. The figures for these lines on the charts above represent the lowest resolving power in each case. Likewise, the six finest lines on the targets comprise group 1, pair 6, and the figures for these lines are the highest on the table.

When examining the negatives you make, you're interested only in the group of lines just cleanly resolved. Next step is to chart your readings.

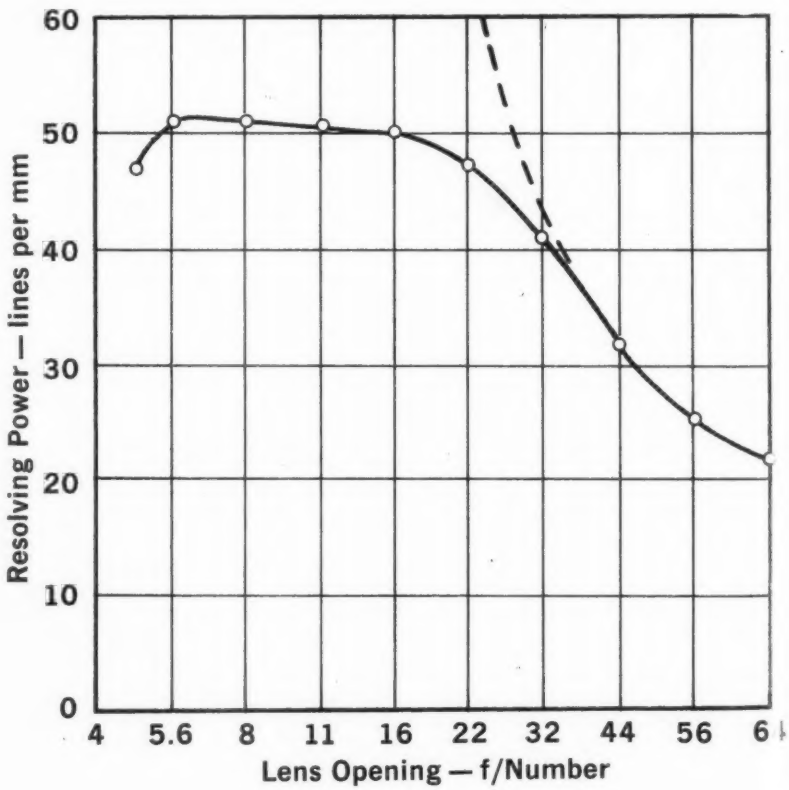
8 CHARTING THE RESULTS

Before you get to making a graph of the results, it's best to take notes on the resolving power readings you get with the negatives you've made. For one you'll want a list of the resolving power of the center targets for the exposures at each f-stop.

The results are graphed as below. This particular graph is for an excellent lens, an f/4.5 Tessar of 162mm focal length. On this type of test, the higher than 50 lines per millimeter resolving power is quite acceptable for even a lens designed for 35mm cameras, although an unusually good lens for 35mm cameras might go as high as 90 lines-per-mm resolution.

It may surprise you to see that the lowest resolution is achieved when the lens is closed way down to f/64. This is not unusual; in fact, it's the rule. The loss of resolution at small apertures is the everpresent result of diffraction introduced by the iris diaphragm. The dotted line in the graph shows the resolving power limit set by diffraction.

If you look at the line connecting the resolving power at each of the f-numbers, you'll see that it rises sharply from f/4.5 to f/5.6, its highest point, then remains fairly level up to f/22 or f/32, at which time it falls off sharply again. All of this indicates that the lens is properly designed for the intended purpose, namely the making of medium length exposures. If you were to make a copy of flat subject matter, for example, with this lens it is obvious that no purpose would be served by shutting down beyond f/16.



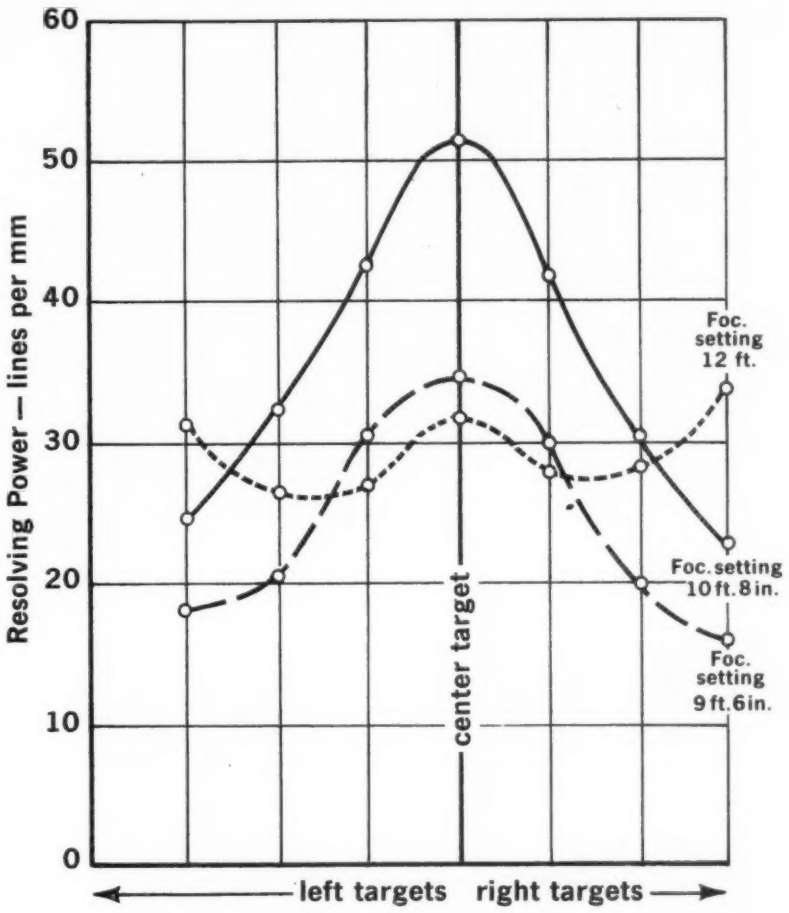
9 CORNER SHARPNESS AND ALIGNMENT

A photographer is interested in more than the highest resolving power delivered at the center of the field. Corner sharpness is important too, as is focusing accuracy and the alignment of the lens to the film plane.

To obtain a maximum of information about these matters, another test is indicated.

In this test you set up the camera as described previously, and make an exposure with the iris diaphragm set at the opening with which it delivers maximum sharpness. Then you make two more exposures, one with the focus setting first just a few *inches* greater, and a second with it set just a few inches less than you know to be proper.

When the negatives have been processed, you make a chart like the one at right, which happens to be the result of tests made with a 162mm f/4.5 Tessar set at f/5.6.



What is to be concluded from these results? Well, it is obvious that the highest resolving power is attained when the focusing scale is set at 10 ft. 8 in. That is quite as it should be because the actual distance for all three of the tests was exactly 10 ft. 8 in.

However, when the focus is set at 12 ft. with this distance, the resolving power for all the targets shown on the negatives is much more equable, hovering in every case around 30 lines per mm. In making a copy of a printed page where consistent sharpness over the entire negative is important, one might conclude from this information it might be wise *not* to focus on the center of the image but rather to the right or to the left when working with this lens.

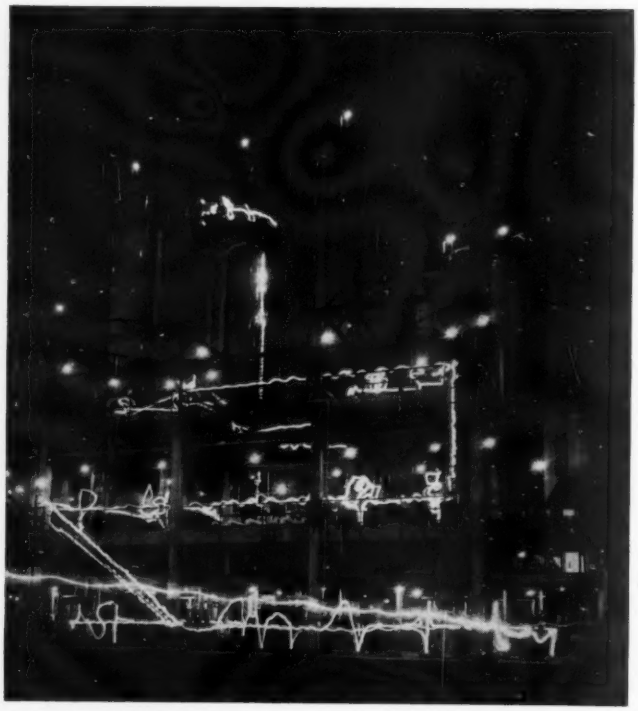
The line which represents the resolving power of the lens when focused short of the target, in this case at 9 ft. 6 in., resolving power at every location falls off, illustrating the futility of such a procedure.

The fact that increased edge sharpness is gained by focusing for a longer distance indicates that the sharpest field delivered by this lens is curved slightly toward the lens. This is true of most lenses. Depending upon the application of the lens it may be good or bad. In a portrait lens it may be highly desirable. In a copy or enlarging lens it may be unacceptable. In some critical applications the film itself is curved in special holders to overcome this inherent difficulty.

You'll notice in looking at the graph that the lines, especially the line representing a focus setting of 12 ft., are tilted slightly.

This indicates that the film is not quite square with the lens. The effect can be far more severe than is shown here. It could be due to bad lens mounting, to a lens board being slightly out of alignment, to lack of parallelism between the front and back of the camera, worn film holders, to the spring back of the camera being loose or to the film being improperly loaded in the holder. In a miniature camera, such a defect is more likely to lie with the mounting of the lens on the camera or with an improperly functioning pressure plate.

GILBERT KENNA, New Haven and Hamden, Conn., free-lancer, placed burner fuel spray nozzles on a sheet of glass, and made this shot for the M B Manufacturing Co., New Haven. 3½-in. 90mm Graflex Optar W.A. f/6.8 Graphex full sync shutter. Graphic View II, 2 sec., f/16, 4 x 5 Super Panchro-Press, Type B.



CHARLES MORRIS, JR., Sun Oil Co., Marcus Hook, Pa., made this triple exposure on Royal Pan. First exposure, in daylight to get plant f/32 1/50. Second, after dark for plant lights f/16 for 1 min. Third, in darkness f/8 with shutter open for operator's tour of plant. 4 x 5 Graphic View, 3-in. Schneider Angulon lens.

PMI's Monthly

READERS' SHOWCASE

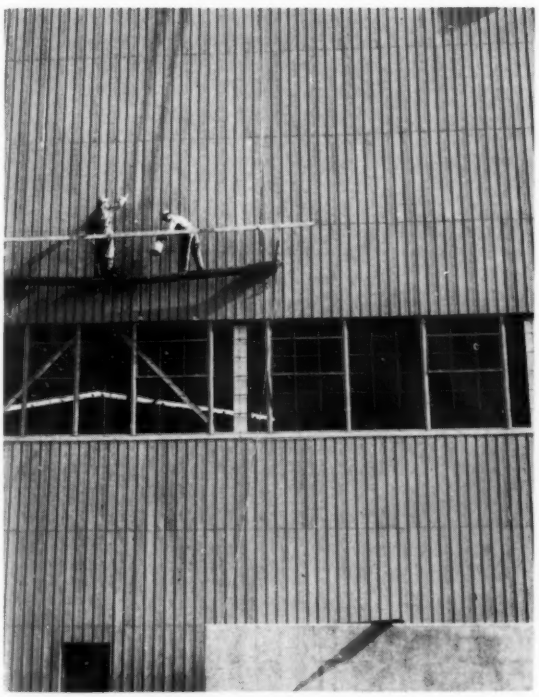
PMI's readers supply solutions to industrial photo problems

The test of an industrial photographer's imagination is how dynamically he can make each shot show its point. The pictures on these pages have all made their point, and at the same time are arresting. Arthur Schoeni considers getting pictorial shots aboard an aircraft carrier the most difficult of assignments. His shot of the F8U-1 Crusader displays the power of this airplane and makes a dramatic picture at the same time. Charles Morris, Jr. wanted to see what the motion of a plant operator, carrying a flashlight on his rounds, would look like traced in light. Morris made a triple exposure which ultimately traced the operator's complete tour of inspection. Gilbert Kenna was faced with making some spray nozzles look eye-catching. He used an old pro's trick and carried it to perfection with a wide-angle lens. The composition in Gary Warstler's shot of the painters speaks for itself, and Joseph Ackerman's brewmaster portrait captures the man and job so well that there's no mistaking it.

You are invited to send in your pictures for this feature. Here are the details:

There are two rewards for each of the pictures chosen. The first is knowing that your picture will be seen by appreciative fellow professionals. The second is $10.00. Please include your name and your company's name, a note about the picture and how it was used, and the technical data. Send them to SHOWCASE, PMI, 33 W. 60, New York 23, N. Y.

ARTHUR L. SCHOENI, Chance Vought Aircraft, Inc. Dallas, Texas, created an exciting composition in this shot of the F8U-1 Crusader aboard the U.S.S. Saratoga. He used a Rolleiflex stopped down to f/16, a G filter, and an exposure of 1/250 on Tri-X film. Forty-mile wind buffeting photographer and camera make working on flight deck difficult. Fast, low-flying aircraft make work during operations dangerous.



GARY R. WARSTLER, Republic Steel Corp., Massillon, Ohio, while assigned to cover a construction job, saw this scene, liked it and took it. The print was made from full 4 x 5 negative. Warstler used a Speed Graphic, Royal Pan film, 1/100 at f/16. K2 filter.

JOSEPH ACKERMAN, Longport, N. J., free-lancer made this portrait of a brewmaster for the Camden Beer Co., as one of a series in the story of how a brewmaster oversees the quality of the product. Royal Pan, 12-in. Dagor lens, 4 x 5 Graphic View, open flash and two No. 5 bulbs.

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(*continued from page* 17)

occur rapidly and simultaneously. The finished print is dispensed from the machine in a semi-dry state in a matter of seconds. According to the manufacturer, Cormac Photocopy Corporation, PolyCopy will reproduce continuous-tone images as well as line.

The antiquity of what we assume to be recent developments is often quite surprising. Reflex photocopying, for example, was invented as early as 1839. Experiments with combined development and fixation (mono-bath processing) were reported in technical literature even before the turn of the century. A modern twist to the latter idea is a new self-processing paper which contains the sensitive emulsion and development and fixing agents in separate layers. These agents are activated when the exposed paper is immersed in water. Development takes place and, when completed, is followed by fixation (*U.S. Patent 2,819,166*).

More light on an old subject

What is claimed to be the most powerful gaseous discharge lamp ever to be offered in this country was demonstrated during the Annual Photo Engravers Convention in Cincinnati, Ohio, on October 13, 1958. A product of the Osram Company of West Germany, the XQO 20KW Xenon lamp has an output of almost a half-million lumens of light. The new lamp is a tube of drawn quartz, 72 in. in length and approximately two in. in diameter. The tube contains Xenon gas at an internal pressure of slightly less than one atmosphere. XQO type lamps are non-pulsing; light generation is continuous. The output is a full-spectrum, brilliant white light with a color temperature in the neighborhood of 6000°K. A unique feature of the lamp is the ability to vary the intensity over a brightness range of over 20:1, with no change in color temperature. The Macbeth Corporation, Newburgh, N. Y., is the exclusive U.S. distributor.

When this new lamp becomes available in usable equipment, the graphic arts will have a choice of Xenon discharge lamps in three different forms: the short-duration high-intensity flash, GE's Pulsed Xenon Arc, and Osram's XQO continuous-burning tube. Experience and available evidence indicates that all three forms will find specialized application in the graphic arts field.

—THE END

THINK VISUALLY

(*continued from page 27*)

degree of ease with which such equipment may be used is, obviously, another matter entirely. Personal preference enters into this part of our story to a great extent.

Our preference is the Linhof Technika, because it offers all major swings, tilts and other movements when we need control and when we need to shoot larger-than-projection-size masters for reduction later in the process. For direct positive color slides, we haven't found anything to beat the Leica with the bellows device and a collection of lenses. Most of the time we use the 135mm lens because of its ability to focus from infinity to a ratio of 1:1 without taking anything apart! Mighty handy. With the Hektor at one end, and the Focaslide holding a IIIf body at the other, we are confident of complete control. And we might add that the experience of the user of such equipment has considerable bearing on results.

Do It Yourself . . . Or Buy?

Yes, but what is the *best* way to get a really effective visual pitch? Do it in the department, or buy parts, or all, of the production? It's a good question, and one you should ask seriously for each proposed effort.

If you have the inclination, the time, and the equipment to do an efficient job, by all means have at it! There are no secrets, just considerable effort and a lot of know-how. If you lack any of these essentials, but have a budget, by all means call in a capable slide film producer to handle, preferably, the whole package. Put emphasis, in this case, on the word *capable*.

In either case, you can't lose. You can follow the basic rules and "do-it-yourself," or you can buy it from a capable supplier. Either way, you will be able to point with pride to the screen and say, "That's *our* pitch!"—THE END

PMI columnists welcome questions about electronic flash, reproduction, color, motion pictures or any other aspect of photography in industry. If you wish a personal reply, please enclose a self-addressed stamped envelope. Address is: PMI, 33 W. 60th, New York 23, N. Y.

METHODS FOR TOMORROW

(*continued from page 15*)

cuts, drawings, etc., that are anything but realistic. The photographic illustrations speak for themselves, leaving no doubts in the mind of the reader about their authenticity.

Limitations of color

No end is served by trying to force photographic materials to adhere to standards they cannot reach. No improved technique or new piece of equipment can turn a color film into an exact means of color reproduction. Despite repeated warnings by color film manufacturers, photographers often attempt to apply color materials in ways that demand exact color reproduction. In an article by Dr. R. W. G. Hunt entitled "Reproduction of Colour" (*Research*, Nov. 1958, pp. 432-438) the folly of such attempts is again emphasized. In his concluding remarks, Dr. Hunt states in part:

"For fundamental and unavoidable reasons, simple trichromatic methods of colour reproduction cannot result in exact colour rendering, and the errors inherent in all systems are considerable when measured physically." THE END

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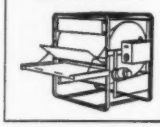

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PHOTO BOOKS IN REVIEW

INTRODUCTION TO PHOTOGRAPHIC PRINCIPLES, *L. Larmore, 229 pp. Prentice-Hall, Englewood Cliffs, N.J. $8.*

Directed at the serious amateur, this book will go far toward whetting his appetite for the technical side of photography. It avoids bombarding him with mathematical formulae, which would only deter, rather than stimulate, a budding interest.

Cameras, optics, films, image formation and its measurement, processing, chemistry and color are all presented in orderly, succinct chapters. Each of these aspects of photography is treated briefly enough so that the reader can easily see its relationship to the whole, instead of losing himself in details. In his treatment of optics, however, the author goes into greater detail and one can't help but feel that some of this labor might have been better spent elsewhere in the book—to expand the section on color, for example. In defense of the author, it must be said that the treatments on optics are fundamental and clear considering the complexity of the subject.

A series of practical experiments is given at the close of the book so the reader himself can demonstrate many of the principles described.

HANDBOOK OF PHYSICS, *E. V. Condon and H. Odishaw, Editors. 1504 pp. McGraw-Hill, 1958, $25.*

Along with the growth of modern technology came a rapid mutliplication of the literature on the physics of materials. The physicist, however, not only had to concentrate on a narrow specialty, but had to keep well informed about all other phases of his profession. This one-volume compendium attempts to provide a broad spectrum of information as up-to-date as preparation and publication processes permit.

Although written for the physicist and somewhat afield of photography this handbook does have something to offer photographic technicians which deserves mention. It will be found especially informative and helpful for those who find a need to quickly brush up on some aspect of geometrical optics, electromagnetic waves, photometry and illumination.

color vision and colorimetry, diffraction and interference, fluorescence and phosphorescence or mathematics.

More than 85 physicists and other specialists contributed to the 90 well-integrated chapters, and the 1504 pages reflect a tremendous amount of careful planning by the editors.

CONCEPTS OF CLASSICAL OPTICS, *J. Strong, 692 pp., W. H. Freeman & Co., San Francisco, Calif., 1958, $9.50.*

This book is a text for an intermediate course for those with a basic knowledge of optics. The author states that an understanding of calculus, vectors and complex numbers, plus a familiarity with electricity and magnetism are prerequisite.

Given sufficient academic background this book has a great deal to offer all who are deeply interested in photographic theory. In addition to the chapters, "Application of Physical Optics," dealing with subjects such as reflection reducing overcoats and interference filters and "Magnification, Aperture and Field," you will find sections on fiber optics, modern trends in methods of lens design, some modern concepts of light and optical filters.

Anyone who mistakenly thinks that the field of optics currently embraces little that's new will find in this book orientation to the recent rapid advances in the field.

THE REPRODUCTION OF COLOUR, *R. W. G. Hunt, 208 pp., Macmillan Co., New York, N.Y., 1957, $12.75.*

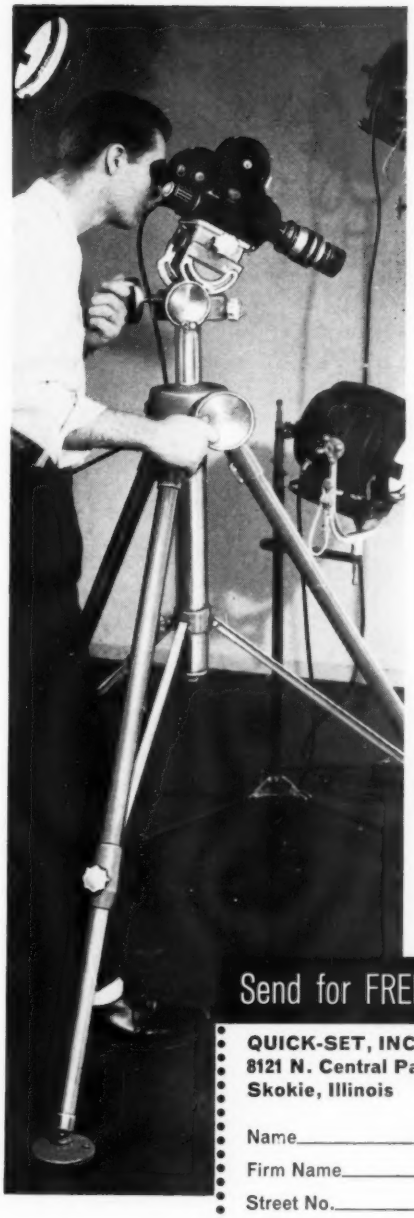
Looking for a book to take the hocus-pocus out of color reproduction? Well, here's one that's well written and goes far to clear a path through the intricacies of the subject.

You will find in these pages lucid explanations of theory and application of trichromatic reproduction and the additive principle, subtractive methods, the color triangle, standards, masking, half-tone printing and television transmission of color. Also, the author stresses the importance of subjective interpretation and carefully details the elements involved.

The text is generously illustrated with both line and color diagrams and there are color plates to show components necessary for four-color lithography, letterpress, gravure and masking for color.

For the serious student this engagingly written comprehensive book will pay for its shelf space in a short time.

Reviews by EUGENE OSTROFF



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Photographers who complain bitterly that their cameras are so sloppily designed that they can't use the rangefinder while looking through a telescope, and get shake when they release their shutters while playing the accordion, should thank their lucky stars they're not draftsmen. The whirling dervish pictured here is designing the lines and shapes of the cars of the future in the Chevrolet Engineering Center at Detroit. Now we know how American cars get to look that way; still wanted is a layout of pictures showing why. Why does PMI reprint this abridged version of a feature carried in FRIENDS Magazine? Because it's a fresh and lively approach to the ever-present problem of man-at-work pictures—and every in-plant man should be grateful for any suggestions.

(PICTURES COURTESY FRIENDS MAGAZINE.)

S.R.E. CONGRESS

Four-day visual communications get-together in Chicago is built around slogan "Research today—product tomorrow"

By PMI's special correspondent, Edward R. Farber

The 2000-plus members of the Society of Reproduction Engineers held a four day Visual Communications Congress in Chicago last month. Members are employed in a supervisory or managerial capacity in in-plant operations and related graphic reproduction businesses.

Some seventy-five manufacturers installed diazo machines, electrostatic duplicators, offset presses, cameras, collators and processing equipment and materials, at the Hotel Sherman, and were rewarded by avid interest in new, improved and automated operations.

Collator fever

Convention goers seemed fascinated by the two collators by Thomas Collators called the Gathermatic and Rotomatic. These collate 6,000 and 25,000 sheets per hour respectively and accuracy is assured by a miss detector and a double sheet detector.

Peerless Photo Products new "Quick Silver" photocopy process was announced at the show. It is described as a fast development silver photography process which uses only a single sheet of sensitized paper to make a copy in less than 30 seconds, at a cost of about four cents a copy.

A "big screen" transparency viewer introduced by Tecnifax looks like the latest in luggage, but opens up to disclose a 13¾ x 18¼ in. illuminated surface for visual presentations with transparencies, grease pencils, transparent inks.

Robots are here

A. B. Dick, Ditto and Multilith demonstrated automated offset presses which permitted a printing program to be set up quickly on a series of dials. The master was installed and the machine took over, stopping only after the required number of copies had been printed.

One operator can handle several machines, or perform other functions more productive than tending the press.

Davidson's new press, in which masters were changed by flipping a lever and feeding the master in while the machine was running, drew a fascinated crowd. It was apparent that many users of offset equipment are plagued with the problem of short runs.

Plates made by the Xerox process (electrostatically deposited dry powder photography) were scrutinized and criticized, but still amazed many. A quick, cheap and easy way to make offset plates in quantity. They can then be sent out for reproduction in branch offices or plants. Xerography is doubtless on its way to usefulness in other areas too.

Haloid Xerox "Copyflo" continuous printers were turning out engineering drawings from microfilm at the rate of 20 ft. a minute on a 24-in. wide roll of plain paper.

Another "Copyflo" model was reproducing positive single copies continuously from 35mm or 16mm roll microfilm, positive or negative (not intermixed). Enlargement range is 7 to 24 diameters in 15 steps. The finished copy is 11 in. in width. It will also reproduce from single, opaque or translucent originals at ratios of 46 per cent to 200 per cent of original dimensions.

Micro rental

Microfilming of all kinds is bound to become even more popular since enlarged copies are becoming so cheap and so rapidly available. Of course such machines as the "Copyflo" are not low in price. Seventy thousand dollars ain't hay, but rental charges ($950 a month) might be easier to take. Smaller machines at $9,900, or a rent of $200 a month will be available next fall.

Haloid also presented its new "Lithoflo" processor, which automatically turns out developed graphic arts cut sheet negatives, closely controlling time, temperature and agitation.

Just how many shops need to process as many as a hundred and fifty 20 x 25 sheets an hour remains to be seen, but processing time control of plus or minus 5 per cent, temperature control plus or minus one degree and four minute mini-

(*continued overleaf*)

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S.R.E. CONGRESS

(*continued from page 55*)

mum for cycling a single film are quite impressive.

Remington Rand turned out a processor at the other end of the film size spectrum with a microfilm unit called the "Unipro." It is claimed to be unique in handling 16, 35, or 70mm continuously or intermixed without adjustment or special attachments. It loads and operates in room light and turns out 100 ft. of dry film in 29 minutes. Price is $1,895.

Unique too is the NuArc line of "Flip-top" vacuum frame printers, so called because the vacuum frame is loaded in the conventional face-up manner. Then the release knob is touched and the entire vacuum frame pivots face downward for fool-proof, even exposure. The arc is enclosed on all sides during exposure.

K & E's team

K & E showed both variable and fixed focus "Helios" microfilm 35mm enlargers permitting enlargements on diazo papers up to 18 x 24-in. with exposure times of 15 to 60 sec. The variable focus unit has a processor built into its base.

Striking in styling and conception is the 105mm system which will photograph and reproduce drawings up to 40 x 60 in. Companion piece is the K&E Electrostatic Printer, which will work semi-automatically with most existing projection equipment. A single control button starts the operation cycle, charging the paper, exposing it, transporting it to the toning chamber, into the fusing chamber, and delivering the finished print, all in less than one minute.

Verticals coming up

Small, compact, vertical cameras particularly designed to appeal to offset-duplicator users attracted much attention. Robertson, Kenro Graphics, and the M. P. Goodkin Co., offered such units with "Xerox" attachments available. All three units placed much emphasis on simplicity of operation. Certainly the trend is towards mass-production methods and away from the need for highly skilled operators. Automation not only can increase production, but decrease labor costs.

Automatic blanket washing on a duplicator can bring such blessings. Overheard while watching the immaculate model feeding a new plate into the Davidson with her lily white hands: "Well, I wouldn't have any trouble getting a gal to run that machine."—THE END

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By H. BAINES, *Kodak, Ltd., London*

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Victor Animatograph Corp. 24-page booklet tells "How Industry Profits from the Use of Sound Films."

Projection Lamp Guide **245**
Westinghouse Lamp Div. 20-page reference chart is a quick reference for replacing projection lamps in motion picture, slide, microfilm, stereo and special projectors.

Sound Projector **201**
Victor Animatograph Corp. 4-page folder outlines features of Victor 1600 Arc sound projector.

Projection Lamp **202**
Westinghouse Lamp Div. Catalog sheet on new "Focus-Loc" projection lamp, latest in the "Blue Top" line.

Screen Projector **203**
TelePrompTer Corp. Catalog sheet treats the TelePro 6000 front- and rear-screen projector.

Communication **204**
Tecnifax Corp. 12-page booklet contains an address, "But . . . Is Anybody Listening?" given at recent Tecnifax Seminar-Workshop in Visual Communication.

Light-Proof Draperies **205**
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CAMERA & LENS

Research with Miniature
Standard Camera Corp. 70-page book, *The Miniature Camera, a Major Research Tool* by Gerard O. Walter and Theodore S. Schultz, describes the applications of photography in research and engineering. Includes nomographs for determination of depth of field, proper shutter speed and the exposure of bellows extension. A section covers the Praktina camera and its accessories. Address requests to PMI, Readers' Service, 33 W. 60th St., New York, N.Y., on your letterhead.

Nikkor Lenses **206**
Nikon Inc. 8-page booklet gives detailed description of the 17 Nikkor lenses available for 35mm cameras.

Novoflex **207**
Voss Photo Corp. 12 catalog sheets outline Novoflex system of telescopic and follow focus lenses and accessories.

Makro-Kilar **208**
Kling Photo Corp. 4-page folder depicts Kilfitt Makro-Kilar f/3.5 40mm lens for Alpa Reflex.

Oscilloscope Cameras **209**
Du Mont Instrument Div. Catalog sheet on various oscilloscope recording cameras and photographic accessories.

Kerr Cell Camera **246**
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Robot **247**
Karl Heitz, Inc. 32-page booklet, *No, Register Photographically* treats in detail the Robot sequence camera systems of photographic recording.

Schacht Lenses **210**
Agof-Schacht Corp. 8-page folder describes Schacht's Travegon wide-angle, Travenon and Travenar lenses.

EQUIPMENT

Car-Top Platform **220**
Carter Mfg. Co. Catalog sheet covers CarPac detachable full length car-top platform for still and motion picture photography.

Alarm Relay **221**
Miratel Inc. Catalog sheet outlines voice operated relay which monitors any service using audio frequency.

Contact Printer **222**
Siok Universal Photo Printer, Inc. 6-page folder outlines Siok Universal Contact Printer designed especially for variable contrast paper. Other papers may be used.

Lighting **224**
Natural Lighting Corp. 24-page booklet gives data on ColorTran line of lighting equipment.

Pocket Microscope **225**
Karl Heitz, Inc. 4-page folder describes the Omag, a pocket microscope with built-in illumination.

Photo-Microscope **226**
Carl Zeiss, Inc. 12-page booklet treats in detail Zeiss' photo-microscope. Can be used with either transillumination or epi-illumination.

Autofocus Enlarger **227**
Charles Beseler Co. 4-page folder treats Model 45AF Autofocus enlarger for negatives from 8mm to 4 x 5.

Filters **228**
U.S. Photo Supply Co. Catalog sheet on Walz precision filter. Includes prices.

Color Processors **229**
Leedal Inc. 6-page folder lists color processing units of varying dimensions and capacities.

TV Monitors **230**
Miratel Inc. Catalog sheet gives specifications on eight television closed circuit monitors in various sizes and mountings.

Densi-Timer **231**
Lektra Laboratories, Inc. Catalog sheet treats the Densi-Timer enlarging light meter.

Color Processor **223**
Ro-Nan, Inc. 5-page file folder gives data on Model EAEC 16mm continuous film process machine.

SUPPLIES

Technical Bulletins **233**
Ansco. Two technical bulletins cover Ansco Ardura and Indiatone projection paper.

X-ray Darkroom **234**
Ilford Inc. 32-page textbook guides X-ray darkroom worker in care and processing of X-ray films, many techniques applicable to the X-ray darkroom.

GRAPHIC ARTS

Arc Lamps **235**
Jos. Gelb Co. 6-page folder describes Gelb arc lamps, vacuum printing frames.

Microfilm Reader **236**
Griscombe Products, Inc. Catalog sheet outlines 17-lb. portable microfilm reader for 16 and 35mm film.

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Microfilm Camera **237**
Griscombe Products, Inc. Catalog sheet on 35mm microfilm camera.

Contact Screens **238**
Caprock Developments. Folder on Caprock Universal grey contact screens.

Lettering Instrument **239**
Varigraph. 36-page booklet illustrates over 48 type faces available with the Varigraph lettering instrument, various lettering aids.

Copy Machine **240**
Maltby Co., Inc. Folder on Photorapid photocopying machine.

Materials **241**
Ilford Inc. 42-page indexed reference catalogs of Ilford graphic arts materials. Includes plates, films, chemicals and formulas, recommended techniques for application.

MOTION PICTURES

Camart Products **211**
The Camera Mart Inc., Catalog sheet of ten Camart products designed for industrial motion pictures. Includes prices.

Edge Film Numbering **212**
S.O.S. Cinema Supply Corp. 4-page folder describes Moy Visible Edge Numbering Machine. 16, 17½, 35mm models.

Recording Studio **213**
Metropolitan Sound Service, Inc. 4-page folder lists sound studio rental rates, facilities, stock charges.

Multidata Camera **214**
Flight Research Inc. 8-page booklet treats in detail the Multidata IV-C photographic data recording camera.

Cine Calculator **216**
Florman & Babb. 4-page brochure outlines Kelly Cine Calculator, a slide rule in disc form for figuring time and footage with 8 and 16mm film.

Eastman Films **217**
Eastman Kodak Co. 12-page booklet charts data and characteristics of thirty-six 16 and 35mm Eastman motion picture emulsions.

Animation Equipment **218**
S.O.S. Cinema Supply Co. 11-page pamphlet catalogs 102 items of animation equipment, accessories.

Time-Lapse Equipment **219**
Rolab Photo-Science Laboratories. 16-page booklet catalogs apparatus for time-lapse work and cine-photomicrography. Includes prices.

Lubrication **232**
The Distributor's Group, Inc. 29-page folder describes FilMagic Pylon Kit for automatic lubrication of recording tapes and motion picture films.

SERVICES

Photo Services **242**
Weiman & Lester. 12-page price list of black-and-white, color, special photo processing and printing services offered by this New York firm.

Color Processing **243**
Norman Kurshan Color Service Inc. File card folder lists complete color processing, printing, duplicating services offered by this New York firm.

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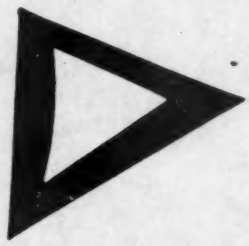

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NEW PRODUCTS

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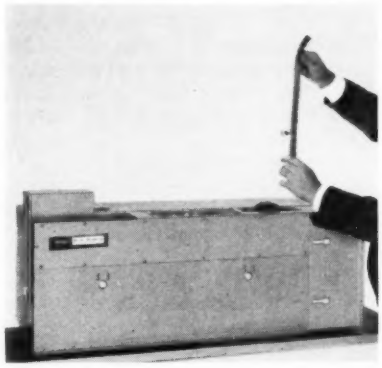
"Mini-Rapid 35" 109

The "Mini-Rapid 35" will process 35mm film automatically at speeds up to 6 ft. per min.—and will handle one length of 35mm still camera film or up to 400 ft. of leaderless motion picture film at one loading, according to Fairchild Camera and Instrument Corp., manufacturer of the unit. It is designed to operate under daylight conditions and use any size film spool.

Film is driven through the processor by means of a plastic drive insert in each solution tank. The drive insert



transports the film and at the same time provides solution agitation and squeegee action.

In normal operation six solution tanks are used. Two developer, two fixer and two wash. The final wash tank is fitted for a circulating water wash, but still water can be used when running water is not available. Tanks and inserts flip in and out for cleaning and solution changing.

Film to be processed is fed into the loading port at one end of the processor. A few minutes later, the developed film is connected to a take-up spool at the other end. Temperature is controlled by a thermostat, can be read during operation on external gauge. Varying the speed during processing changes development rate.

The "Mini-Rapid 35" weighs 120 lbs. and is 15 x 13 x 37 in.

Fairchild also manufactures a previously announced "Mini-Rapid 16" 16mm film processor.

New Camerette 107

In the new Camerette magnetic sound-on-film 16/35mm motion picture camera, the entire double-system unit is contained in a fiberglass blimp. The camera offers the choices of recording on 16mm or 35mm photographic film or 16mm or 35mm fully coated magnetic sound film. It can be converted instantly, the distributor says.

Sound recorder and camera are driven by a 24-volt synchronous DC motor. Amplifier is complete in a separate case; it also operates from a 24-volt source. Two microphone input channels are provided, each with its own input amplifier, gain control and high and low frequency controls. Outputs from both amplifiers are mixed and fed through a volume control to the recording amplifier. Total R.M.S. flutter is said to be 0.15 per cent on 35mm, and about 0.2 per cent on 16mm.

A separate playback amplifier is provided with a selector switch enabling the operator to hear either direct signal or playback. The recorder is also equipped with a high-speed peak volume indicator, built-in tone generator for testing, and provision for circuit metering.

A microphone is provided in the amplifier panel for communicating with the cameraman and for recording soundtrack identification.

A synchronized identification system puts a short pulse tone on the sound track and a mark on the picture film simultaneously.

The camera is a 16/35mm Eclair Camerette. A telescope arrangement carries the eye piece of the reflex viewer to the back of the blimp. It is adjustable for either 16mm or 35mm frame size. Follow-focus control is provided on the blimp. Capacity is 400 ft. of 16mm or 35mm film. Camera is equipped with a three-lens turret.

Camera and sound recorder in the blimp weigh about 100 lbs. Dimensions are 24 x 15 x 17 in.

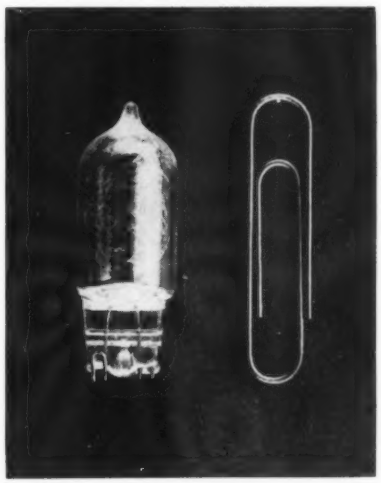
Vertical Process Camera 123

A compact vertical process camera, the "Meteorite," is offered by Robertson Photomechanix, Inc. It is available with a choice or combination of holders such as xerography adapters, vacuum and stayflat film holders, prismatic head (for right reading stats), etc.

Features include automatic timing and exposure control, direct reading percentage focusing sytem, 14 x 17-in. film size and a range of 3X enlargements through 3X reductions. Copy up to 18 x 23 in. can be accommodated in the glass covered copyboard which is illuminated by adjustable incandescent lights. A Goerz lens is standard equipment. The Vacuum Film Holder is complete with a heavy duty pump and motor unit and a zone selector which cuts off the unused vacuum areas.

Tiny Glass-Base Flashbulb 124

The General Electric "All Glass" flashbulb costs 10¢, is the diameter of a pencil, has a length of 1⅝ in., but delivers 7000 lumen-seconds of light—as much as the M2 which is four times the size of the new flashbulb.



The new miniature bulb is Zirconium-filled. Its glass base is said to be designed for accurate and rigid positioning in a suitable reflector. Peak intensity is 400,000 lumens, at 15 milliseconds, permitting use of the bulb with F and X synchronization to 1/60 sec., and M sync at any speed. They are to be marketed in April.

Another version of the bulb with a blue coating for use with daylight color film, delivers 4000 lumen-seconds and costs 12¢.

Kodagraph Autopositive Paper

Sharper engineering drawing intermediates requiring one-third less exposure time are possible with improved Kodagraph Autopositive Paper Translucent, Kodak says.

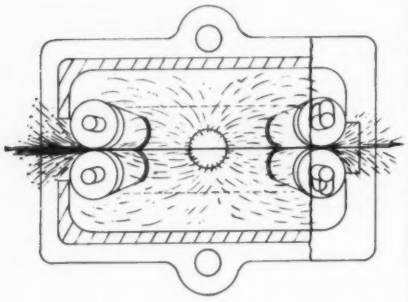
The improvement is said to bring about 60 per cent greater speed, higher effective contrast and increased tolerance to room light.

Sinar Microscope Adapter 114

A double adapter ring arrangement couples the Sinar Convertible view camera directly to the microscope. The adapter has an inside diameter of 25mm and fits over the microscope eyepiece. Another ring fits the camera. The rings are clamped together for shooting; separated for direct viewing through the microscope. The Sinar clamp and camera holder are used to permit vertical

mounting of the camera. Price, with lensboard: $29.95.

Air Squeegee **105**
Cushnblo Air Squeegee said to fit any motion picture processing machine, removes excess solution from film surfaces. Low-pressure forced air provides



a pneumatic cushion as film passes between rollers. The film emulsion touches no part of the squeegee under normal use according to Filmline, maker of the unit. An adjustable gap allows spliced film to pass freely through the unit. Prices: 16mm size, $55; 16mm/35mm size, $68; oil-less rotary air compressors, with motor, to operate from one to six squeegees are $187.50 to $397.

Exakta Speed Light **101**
The Exakta Electronic Flash Unit works on AC house current, three "D" cell batteries, or a nickel cadmium battery in place of the "D" cells. The unit has a flash duration of 1/1000 sec., color temperature of 5500° Kelvin, angle of coverage of 50°. Wide-angle reflectors to cover a 75° angle will be available. Re-cycle time on AC current and nickel cadmium battery is 4 sec., on "D" cells, 8 sec. Guide number for Kodachrome is given as 35. A guide number of 145 is recommended for e.i. 100 black-and-white film. The Exakta Electronic Flash Unit weighs 3½ lbs., including leather case and shoulder strap. Price: $49.95. A macro ring light is $39.50. Nickel cadmium battery is $5. Battery recharger is $9.

"Free" Test Light **102**
A battery test light for flashguns will be available early this year without additional charge with the purchase of a 12-bulb pack of either G.E. No. 5 or M2 flashbulbs.

The test light comes in both M2 and No. 5 base sizes and can be used with all battery packs from three volts to 22½ volts and also with BC flash units.

Quick Release Clamp **103**
A quick release E-clamp made by Photo Lectronic Research is designed to fit all standard 1⅛-in. diameter and off-round battery cases, flashguns and mounting tubes. It is said to be strong enough to permit carrying 4 x 5 press cameras by the flash apparatus. It has a flexible stainless steel band and a large knurled release knob made of aluminum. Price: $4.95. A camera clip for mounting the clamp is 85¢.

Reflector Attachment **104**
A new 6¾-in. Enteco Polariflash may be fitted to flash reflectors up to 7½-in. diameter, and to photoflood reflectors. Price: $26.95. Other sizes from 3¼ in. diameter are $7.50 up.

2¼ x 3¼ Single-Lens Reflex **110**
The Rittreck 2¼ x 3¼ Single-Lens Reflex, which uses either roll or sheet film, is equipped with Luminant lens and preset diaphragm. It accepts interchangeable lenses from 90 to 400mm. Focal-plane shutter operates from 1/20 to 1/400 sec., plus T and B, and has synchronization for bulbs and electronic flash. The camera can be focused as close as 13 in. with the 105mm lens without accessory lenses or extension tubes. A field lens is built into the viewing screen. A focusing magnifier and sportsfinder are also provided. The roll film holder for the Rittreck comes with masks for 2¼ x 2¾, 2¼ x 2¼, or 2¼ x 1⅝ format on 120 film. There are 2¼ x 3¼ sheet film holders also available for the camera. Price with Luminant lens is $195.

For additional information on any new products item, circle the appropriate number on the readers' service card attached to page 59

Adjustable Boom Clamp **111**
PLR adjustable boom clamps are designed to convert light stands into boom lights. They use "frictional-spring-tension" for free movement into any position. Models are available for light stands ¾ to 1 5/16-in. diameter and booms of ½ to ¾-in. diameter. Prices range from $4.95 to $8.50.

Polaroid 35mm Changer **112**
A new changer for the Polaroid projector now makes it possible to show regular 35mm slides with the machine. The changer is manually operated and made of stainless steel. Price: $4.95.

Praktica Adapter **113**
A microscope adapter for the Praktica 35mm waist-level reflex camera consists of: a hinged adapter which fastens to the draw-tube of the microscope, a 50mm extension tube, and a camera adapter. The hinged adapter swings the camera away for microscope focusing and observation. Pictures may be made either with the ocular removed from the draw-tube or in place for additional magnification. Price: $25.

Data Retrieval Machine **106**
FLIP (Film Library Instantaneous Presentation is designed to locate and display a desired frame in a reel of specially processed 16mm photographic film. The film transport of the machine is designed to accommodate 1,200 ft. of 16mm film, containing up to 72,000 frames of information. During the scanning interval, photosensitive elements read coded binary digits represented by the presence or absence of code bars adjacent to each frame. The manufacturer, Benson-Lehner Corp., says that the machine may be used to store any type of information which can be photographed, and that it will retrieve and display the information instantaneously on command.

Filmsort Plans 6 Units **108**
Six new machines to be used with microfilmed engineering drawings in aperture cards will be released early in 1959 by the Filmsort Co.

A revised version of the Inspector "50," to be known as the Inspector "51," now incorporates "value analysis." The Inspector "51" also has an adjustable clamp.

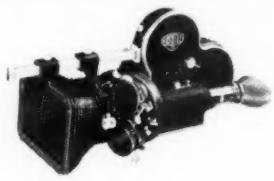
The Designer "184" has a screen size slightly larger than 18 x 24 in. Its optical system covers the entire microfilm frame within the aperture. It has no glass flats. Instead, card and film are held in plane by a bakelite holder for tab cards and 3 x 5-in. cards. The holder can be rotated 90 to 180 degrees and has a card stop for Military "D" location. To extend lamp life, the off-on switch sends 15 volts into the 300-watt bulb filament to keep it constantly warm. Insertion of the aperture card switches on full voltage. The cabinet shields out extraneous light. A 65mm f/4 Leitz, Ltd., of Canada, lens is said to distribute 20 to 25 foot candles of light everywhere on the screen. Price has not yet been set.

The Draftsman "128" will have a 12 x 18-in. screen and 10X magnification. A lower-priced unit than the Designer, the Draftsman will have smaller cabinet, screen and mirror and a less expensive lens. The transformer and card-activated switch will be eliminated.

A combination diazo exposure and development unit, the card-to-card UNIprinter "085" will be priced at $750. It uses a standing sunlamp for exposure and crystals for development. In addition, Filmsort is now designing a completely automatic card-to-card diazo UNIprinter scheduled for production later this year.

A revised semi-automatic Optical

ARRIFLEX 16



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Mounter is expected to free the mounter operator from the necessity of making mechanical adjustments. Field tests indicate that the glass anvil stays cleaner; access to the punch is simpler facilitating clean-out of film chips, and an improved exhaust system carries heat away from the operator, Filmsort says. Other features include retractible film guides, improved film feeders and advance.

Recording Camera **117**

The "Copy-Cart," a new recording camera has just been introduced by Peerless Photo Products, Inc. The new camera combines in a single portable unit a continuous-flow reducing camera and an automatic processor. No darkroom is needed and no water supply is required. Opaque originals up to 8½ in. wide and of any length can be fed into the recorder and are reduced in copying to 70 per cent of their original linear size. By factory adjustment the unit can be modified to furnish any desired single reduction from 50 to 80 per cent of original.

Copies are made on a continuous strip of sensitized silver halide type photographic paper. The originals are returned in the same order as they were copied. The copies, which are right-reading negatives, are automatically developed and stabilized in the processor, dried andd elivered at the rate of approximately 1,500 check-sized originals per hour. Copies are returned, at the option of the user, either cut to appropriate length and piled in the order of copying, or uncut and in roll form.

The camera is 16 in. wide and 38 in. deep, mounted on casters for easy movement from one location to another. Its working surface is desk height, 29 in. from the floor. The case rises an additional 8 in. at the rear to house the rewind roll or cutter. Its total weight is approximately 150 lbs.

A-V Sales Aid **118**

The Charles Beseler Co. announces the Salesmate, a desktop automatic sound slidefilm viewer in an attache case.

Salesmate looks like a lightweight piece of business luggage covered in honey-colored calf-vinyl. One side opens revealing a built-in screen which re-

(Continued on page 66)

For additional information on any new products item, circle the appropriate number on the readers' service card attached to page 59

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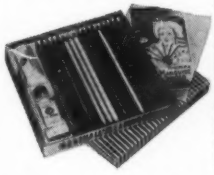

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For latest data on industrial applications of high speed photography, write Industrial Camera Division, Dept. 11, Fairchild Camera and Instrument Corp., 5 Aerial Way, Syosset, Long Island, N. Y. West Coast Office: 6111 E. Washington Blvd., Los Angeles, Calif.

FAIRCHILD
CAMERA AND INSTRUMENT
CORPORATION

Get more information. Circle 416, page 59

IN-PLANT TEST

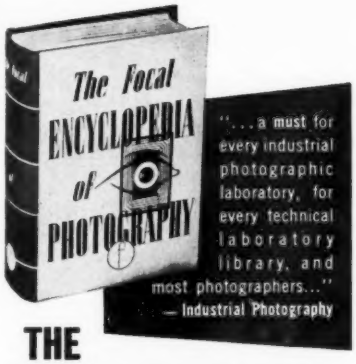
Photomacrography specialist reveals Asahi-Pentax K would have solved tough problem—if only he'd had one handy!

SPECIFICATIONS: Asahi-Pentax K 35mm single-lens, eye-level reflex with semi-automatic, internally controlled diaphragm. Lens: 55mm f/1.8 Takumar with stops to f/22, focuses to 18 in. *Shutter:* Focal plane 1 to 1/1000 sec., MX sync. *Other features:* Rapid return mirror, Fresnel lens in optical system, rewind crank, single throw film advance lever. *Price:* $249.50. *Importer:* Osawa & Co., (U.S.A.) Inc., 521 Fifth Avenue, New York 17, N. Y.

Werner J. Kuhn, New York City commercial and industrial photographer, reports: Some time ago an out-of-town plant requested an 8 x 10-in. glossy print of the broken end of a machine part about 1/32-in. across the end to be photographed. Lighting with strong, crisp sidelights clearly defined the texture within the tiny area. To achieve the 250X magnification requested, I decided to attempt the first stage of the magnification by ultra close-up photography with lens tubes on a standard rangefinder 35mm camera. A sliding ground glass back provided an image and heavy tripods plus additional braces locked everything in place. After calculating the exposure under the special conditions of the extreme lens tube arrangement, I exposed a few frames and rushed the film to the darkroom to check results. The image wasn't even on the film! In the period during which the ground glass was shifted from its position and the camera racked in, the slight shifts in weight on the tripod had permitted the image to slip from the expected position—right out of the frame! I began all over again. It took additional hours to get the needed photograph.

Handling the Asahi-Pentax, I could appreciate immediately the advantages that this slim, well-designed single-lens reflex could have brought to that problem. The ground glass within the camera insures that the field sought has been found; then the mirror which quietly snaps back up instantly after the exposure reveals what actually has been photographed. The photographer's own persistence of vision extends the apparent image partially into the period when the mirror is out of the way so that the shutter, lens and film may function together.

For my money, the Asahi-Pentax offers all the versatility that long ago made the single-lens reflex design popular as a research laboratory tool. It combines the advantages of the focal-plane shutter system with the performance of cameras that accept lenses in a range from wide-angle to ultra-telephoto. The Pentax camera's own Takumar lens system runs from a 35mm f/4 up to a tripod mounted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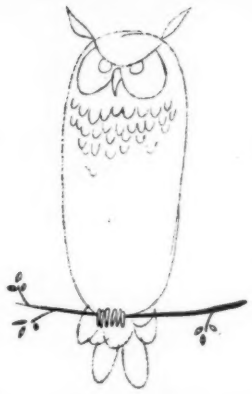

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1000mm f/8; the Takumar lenses are also Asahi products.

I have owned an Asahi-Pentax S, and for this test I was lent the newest Pentax, the K. The K offers a 1000 sec. top shutter speed, and most important, an automatic diaphragm. Initially, the automatic diaphragm is in three lenses—the 35mm f/4, a 55mm f/1.8, the camera's basic lens, and a 105mm f/2.8.

In addition, the Pentax K offers improved ground glass performance with a combination bull's-eye zone in the center and a Fresnel-lens construction to give edge and corner brightness. Cross markings in the very center of the ground glass keep the image obscured until the precise focus is achieved; then the image leaps into sharpness. This helps greatly in adjusting yourself when you switch from an 8 x 10 in. ground glass to one only 1 x 1½ in. By the way I wear glasses and they don't impair the view through the Asahi. The automatic diaphragm eliminates handling the lens once a critical focus set-up has been achieved. This again forestalls a possibility of camera movement.

The automatic diaphragm is coupled internally, making this camera also one of the most compact single-lens cameras ever designed. Furthermore, a U-shaped tripper device just behind the lens will depress the firing pins on a large number of lenses compatible with the Takumar mount. Included are lenses for the Praktica, Contax S, D and others.

In my opinion the major advantage of the Pentax to the working photographer is the mirror return feature necessary whenever precision framing, or catching moving subjects in their proper relationship, is required. That goes for most of my pictures. I think the Pentax is a truly professional tool. —THE END

KODAK FILM WALL CHART

The Eastman Kodak Company has prepared a handy wall chart listing specifications for all its 16, 35, and 70mm films, covering black-and-white and color emulsions, special-application films, core and spool characteristics, and other hard-to-come-by data.

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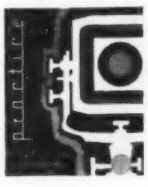

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NEW PRODUCTS

(*continued from page 63*)

sembles a 17-in. TV. The unit is plugged in and a press of the button starts the sound and pictures. Salesmate automatically completes the presentation then shuts itself off. The Salesmate show consists of up to 150 still pictures accompanied by up to 12½ minutes of sound. The pictures are automatically synchronized with the sound. Because both film and tape are on continuous loops, rewinding is eliminated. The device measures 17½ x 13½ x 6 in. and weighs 19 lbs.

Projection Lamps **119**

New General Electric lamps have internally mounted mirrors which, it is said, will cut cost of future projectors by reducing the need for separate reflecting surfaces and light collection lenses. The built-in mirrors will also result in brighter pictures, it is claimed, since the mirrors are protected by the lamp itself from discoloration caused by atmosphere.

They are 500-watt, four-pin base, gold-topped lamps. The CZA has application in many movie and slide projectors. With its single reflector, a half-inch square of bright metal, it is said to produce as much or more light than conventional lamps with external mirrors. Its effectiveness is increased by its built-in reflector which will not discolor. The CZA's small "proximity" reflector serves the function of returning light through the openings in the filament making the source brighter.

The DFR is similar to the CZA except that it can be operated horizontally as well as vertically. In addition, it has a locking-type pin base. The DFR also has a screen above the mirror and filament which prevents bulb blackening in the light path. It does this by controlling the movement of the hot gases and vaporized tungsten within the lamp. The screen acts with the internal mirror to virtually eliminate blistering, always a problem with horizontally operating lamps.

The DFR is designed for use in current slide projectors. Prices are: CZA $4.65, DFR, $5.25.

8/16 Film Computer **116**

Ready-Eddy is a plastic disc computer to assist professionals in planning, shooting, timing, cutting, editing, projecting, etc. 8 and 16mm motion pictures. It gives answers to such questions as: What is screen time for a given footage at sound or silent speeds? How long must a film or scene be for a given period of screen time? How many frames are required for a certain action or effect? What is the total footage added up from a given number of scenes, also its screen time?

Ranges are from ½ ft. to 1,638 ft., and from 1 sec. to 45½ min. All answers appear in the one-line window of the indicator. Price: $2.95.

Diazo Machine **120**

Reproduction Engineering Corp. has announced the 1959 models of the Blu-Ray Rotary Diazo Printer which incorporate several modifications. Printing speeds have been stepped up 50 per cent by a revision of the light source and with an air cooling system. A belt and pulley drive has been added to the paper feed. Cases on the new models are removable by means of snap fasteners.

Stikvelopes **121**

A Stikvelope is an envelope whose faces are coated with adhesive. The user inserts his negative inside the envelope, sticks one face of the envelope against the back of the photo and then sticks the other face of the envelope against an album page, bulletin board or other surface. When mounted, the Stikvelope is out of sight; photo lies perfectly flat. As a filing device for negatives, Stikvelopes permit visual identification of negatives. The user looks at the picture on the Stikvelope—the negative is inside.

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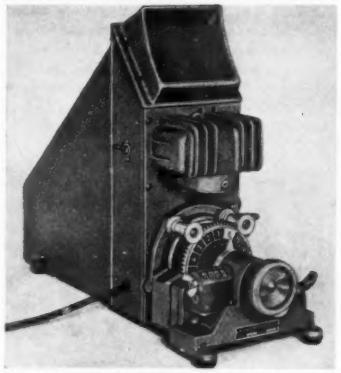

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PHOTO DEPARTMENT

(*continued from page* 30)

"out on location" around the plant where routine photographs are taken by non-photo department personnel. There is also a Polaroid Land setup at a location spot.

A 24-in. ATF Process Camera, with a room to itself, is floated against vibration. A Kodagraph Model D microfilmer sees a lot of action around this time of year, when the annual crop of research notebooks are microfilmed for the library.

Devoted entirely to the research aspect of the photo operation are two Gamma Reflexes, a 5 x 7 Linhof Technika, 5 x 7 Bausch & Lomb and 5 x 7 Bausch & Lomb "L" Photomicrographic unit.

A 16mm Arriflex with a full complement of accessories is always ready for movie making, but McWilliam is just as apt to use his own Bolex H-16 for location shooting. There is also a 35mm Arriflex—but it hasn't been used yet. It's slated for use with a Galileo Inverted Microscope and will be devoted to time-lapse operation.

The studio camera is an 8 x 10 Ansco View, which will eventually be replaced.

Other equipment includes two Color-Tran converters, a full complement of enlargers (McWilliam prefers the condenser type for maximum sharpness), light stands, motion picture editors, a Flo-film Universal Microfilm Reader, film dryers, ad infinitum. Some odd bits of equipment are gathering dust in the corners—left over from the time when Lederle maintained a smaller studio in New York City.

McWilliam's department is well-organized and efficient. Each of the ten people who work with him is assigned to a particular area of responsibility—one man to the process camera, one to scientific work in the studio, five to general and outside assignments, two in the art department, one photographic secretary. Independence is encouraged and once a job is assigned, the photographer is responsible for carrying it through to finished print. Barring disaster, McWilliam wants to hear no more about it until the job is completed.

Lederle's is a deceptively relaxed operation—actually a busy, occasionally hectic one. But just in case it ever gets to be too much, there's always lunch—and a help-yourself bottle of vitamin pills on every table.

—THE END

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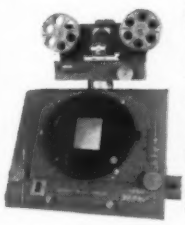

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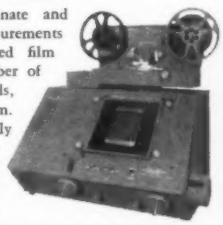

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ADVERTISERS' INDEX

JANUARY 1959

ALLIED IMPEX CORPORATION 16
AMERICAN SPEEDLIGHT CORP. 8
AMPHOTO 53
ANSCO DIVISION (General Aniline & Film Corp.) 5
ARKAY CORPORATION 55

BESELER CO., CHARLES, THE 7
BURKE & JAMES, INC. 63
BYRON, INCORPORATED 20

CALUMET MFG. CO. 10
CAMERA MART 63
CAPITAL FILM LABORATORIES 19

DE GROFF LABORATORIES, INC. 19
DISTRIBUTOR'S GROUP, THE 17
DU PONT DE NEMOURS & CO., INC., E. I. 3

EASTMAN KODAK CO. ..... 9, FOURTH COVER
EDWAL SCIENTIFIC PRODUCTS CORP. 17

FAIRCHILD GRAPHIC EQUIPT., INC. 64

GOERZ AMERICAN OPTICAL CO., C. P. 51
GORDON ENTERPRISES 18

HALOID ZEROX, INC. ..... SECOND COVER
HEITZ, INC., KARL 12-13
HEILAND DIVISION (Minneapolis-Honeywell) ..... Third Cover
HEHN, LESTER C. 17
HUNT COMPANY, PHILIP A. 22

IDEAX CORPORATION 6

JERI COMPANY, INC., ANDREW 63
JOHNKE MFG. COMPANY 52

KALIMAR, INC. 14
KIER PHOTO SERVICE 53
KIN-O-LUX, INC. 63
KLING PHOTO CORP. 65
KURSHAN & LANG 65

LAB TV 19
LACEY-LUCI PRODUCTS COMPANY 56
LENZ WASHER COMPANY 21
LOG ETRONICS, INC. 57

MACMILLAN COMPANY, INC. 65
MARSHALL MFG. CO., JOHN G. 63
MEISEL PHOTOCHROME CORP. 67
MICHIGAN PHOTO SHUTTER CO. 56
MICRO RECORD CORP. 21
MOLE-RICHARDSON COMPANY 67

NATIONAL CINE EQUIPMENT 67

PHOTOGRAPHIC ANALYSIS COMPANY 52
PLYMOUTH PRODUCTS CO., INC. 56

QUICKSET, INC. 53

RAPID COLOR PRINT 56
READERS SERVICE 59-60
ROSS-GAFFNEY, INC. 68

SAFE-LOCK, INC. 50
SPINDLER & SAUPPE 52
STATIKIL, INC. 68
STILL-MAN EQUIPMENT CORP. 56
STRAUSS PHOTO TECHNICAL CORP. 15
STRONG ELECTRIC CORP. 15, 50
SYNDICATE PHOTO LAB 67

VALENTINO, T. J. 15
VANGUARD INSTRUMENT CORP. 67

WHITMORE PRODUCTS 56
WILEY & SONS, INC., JOHN 56
WOLLENSAK OPTICAL COMPANY 21

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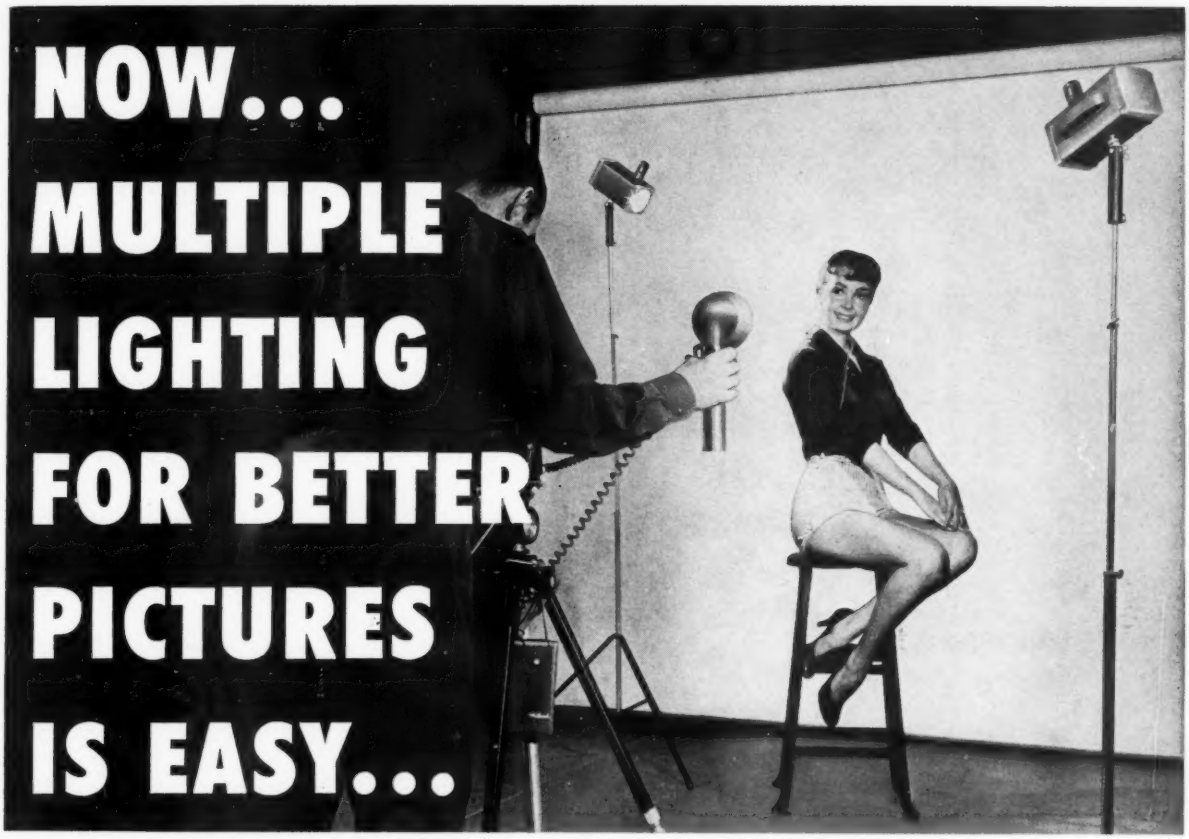

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